Investing in people, discovery and innovation

Departmental Performance Report

for the period ending March 31, 2008

Minister of Industry

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List of Abbreviations

BDC	Business Development Bank of Canada
CCI	College and Community Innovation Program
CFI	Canada Foundation for Innovation
CGS	Canada Graduate Scholarships
CIHR	Canadian Institutes of Health Research
CRC	Canada Research Chair
CRD	Collaborative Research and Development
DPR	Departmental Performance Report
HQP	Highly Qualified Personnel
I2I	Idea to Innovation
IP	Intellectual Property
IPM	Intellectual Property Mobilization
IRDF	Industrial Research and Development Fellowship
MRS	Major Resources Support
NCE	Networks of Centres of Excellence
NRC	National Research Council
NSE	Natural Sciences and Engineering
NSERC	Natural Sciences and Engineering Research Council of Canada
OECD	Organisation for Economic Co-operation and Development
PDF	Postdoctoral Fellowship
R&D	Research and Development
SSHRC	Social Sciences and Humanities Research Council of Canada
USRA	Undergraduate Student Research Awards

Section 1 – Agency Overview

1.1 Minister's Message

The Industry Portfolio experienced a busy and successful 2007–2008. As Minister of Industry, I am pleased with the progress made on our mission to foster a competitive, knowledge-based economy that benefits all Canadians.

A competitive economy is one that provides jobs and opportunity to Canadians, and top-quality products and services to consumers. Our economic performance underpins the quality of life we enjoy in this country, and NSERC is making important contributions to this mission.

The Industry Portfolio is composed of Industry Canada and 10 other agencies, Crown corporations and quasi-judicial bodies. These organizations collectively advance Canada's industrial, scientific and economic development, and help ensure that we remain competitive in the global marketplace.

As a country, we must remain focused on how we can continue to provide an innovative and entrepreneurial economic environment, help our businesses capitalize on opportunities, and provide choice and quality to consumers. The global marketplace continues to evolve, changing with it the dynamics that influence Canada's performance. I am proud to say that the Industry Portfolio is playing its part:

- We are working to make our market for wireless services more competitive, this year launching the policy framework for the Advanced Wireless Services spectrum auction. The framework aims to provide more choice and better service for consumers and businesses — something that we believe will also lead to lower prices.
- We issued guidelines clarifying the application of the *Investment Canada Act* as it relates to foreign state-owned enterprises investing in our country to ensure that Canadians continue to enjoy all the benefits that foreign investment delivers.
- We instituted an independent Competition Policy Review Panel to review and report on key elements of Canada's competition and investment policies and to ensure that they are working to the full benefit of Canadians.
- We created an Automotive Innovation Fund to provide support to automotive firms undertaking large-scale, strategic research and development (R&D) projects to build innovative, greener and more fuel-efficient vehicles. Similarly,

investments made through the Strategic Aerospace and Defence Initiative continue to encourage strategic R&D that will result in innovation and excellence in new products and services.

One of my key priorities as Industry Minister continues to be our country's science and technology (S&T) strategy, *Mobilizing Science and Technology to Canada's Advantage*, announced by Prime Minister Harper in May 2007.

- Budget 2008 included measures and initiatives in support of our S&T Strategy that total $654 million over the next three years.
- We put in place the new Science, Technology and Innovation Council to provide the government with objective policy advice on Canada's S&T issues.
- The government allocated $105 million in 2007–2008 to support the operations of seven new Centres of Excellence, pilot projects that have the potential to make Canada a global leader in fields of research that offer a strategic opportunity for Canadian industry.
- This past March, Canada's two-armed robot, Dextre, was successfully installed on the International Space Station.

This has been a year of progress and success, and it is my pleasure to present NSERC's *Departmental Performance Report* for 2007–2008. I am committed to building on these successes in 2008 and beyond, and I will continue to work with officials in the Industry Portfolio to make Canada more efficient, productive and competitive.

Tony Clement
Minister of Industry

1.2 Management Representation Statement

I submit for tabling in Parliament, the 2007–2008 Departmental Performance Report for the Natural Sciences and Engineering Research Council of Canada (NSERC).

This document has been prepared based on the reporting principles contained in the *Guide for the Preparation of Part III of the 2007-2008 Estimates: Reports on Plans and Priorities and Departmental Performance Reports*:

- It adheres to the specific reporting requirements outlined in the Treasury Board Secretariat guidance;
- It is based on the department's Strategic Outcome(s) and Program Activity Architecture that were approved by the Treasury Board;
- It presents consistent, comprehensive, balanced and reliable information;
- It provides a basis of accountability for the results achieved with the resources and authorities entrusted to it; and
- It reports finances based on approved numbers from the Estimates and the Public Accounts of Canada.

_____

Suzanne Fortier, President
Natural Sciences and Engineering Research Council of Canada

1.3 Program Activity Architecture

Figure 1 presents NSERC's Program Activity Architecture (PAA) in effect in 2007-08. Subsequent to the approval of NSERC's PAA for 2007-08, new programs were launched (see below). NSERC will use the updated PAA in future reports.

Figure 1
NSERC Program Activity Architecture

	1.0 People	2.0 Discovery	3.0 Innovation
Strategic Outcomes	**Highly skilled science and engineering professionals in Canada**	**High quality Canadian-based competitive research in the NSE**	**Productive use of new knowledge in the NSE in Canada**
Program Activities	1.1 Promote Science and Engineering 1.2 Support Students and Fellows 1.3 Attract and Retain Faculty	2.1 Fund Basic Research 2.2 Fund Research in Strategic Areas	3.1 Fund University-Industry-Gov't Partnerships 3.2 Support Commercialization
Sub-activities	1.1.1 Science Promotion and Education Research 1.2.1 Undergraduate Student Research Awards 1.2.2 NSERC Postgraduate Scholarships 1.2.3 Canada Graduate Scholarships 1.2.4 Postdoctoral Fellowships 1.2.5 Industrial R&D Fellowships 1.3.1 Canada Research Chairs 1.3.2 Industrial and Other Research Chairs 1.3.3 Prizes	2.1.1 Discovery Grants 2.1.2 Special Research Opportunity Grants 2.1.3 Perimeter Institute 2.1.4 Research Capacity Development in Small Universities 2.1.5 Research Tools and Instruments 2.1.6 Major Resources Support Grants 2.1.7 General Support 2.2.1 Strategic Project Grants 2.2.2 Collaborative Health Research Projects	3.1.1 Collaborative Research and Development Grants 3.1.2 Research Partnership Agreements 3.1.3 Networks of Centres of Excellence 3.1.4 Strategic Networks 3.2.1 Intellectual Property Mobilization 3.2.2 Idea to Innovation Program 3.2.3 College and Community Innovation Program

New Programs

As a result of the 2007 and 2008 Federal budgets and to further the goals of the Federal government's S&T *Strategy*, several new programs were launched, including:

- **Centres of Excellence for Commercialization and Research (CECR)** – The program is to create world-class centres to advance research and facilitate commercialization of technologies, products and services. These centres operate in the priority areas of the S&T Strategy: information and communications technology, environment, energy and natural resources, and health. The program funds the CECRs' operating and commercialization costs.

- **Business-Led Networks of Centres of Excellence (BL-NCE)** - Announced in Budget 2007, the new BL-NCE Program's goal is to fund large-scale collaborative networks to support private sector innovation in order to deliver potential economic, social and/or environmental benefits.
- **Industrial R&D Internships (IRDI)** – The program's aim is to create new opportunities for science and technology graduates. The program will fund internships with the participating businesses for graduate students and post-doctoral fellows to support the government's commitment to growing Canada's base of knowledge workers. The IRDI program will introduce interns to practical business problems while allowing them to apply their expertise to help meet the research needs of Canada's private sector.
- **NRC-NSERC-BDC Nanotechnology Initiative** - This is a special opportunity developed by the NSERC, the National Research Council (NRC), and the Business Development Bank of Canada (BDC) for NRC scientists and Canadian academic researchers in nanoscience and nanotechnology to collaborate on large technology development-driven research projects in the critical areas of: energy the environment and information and communications technologies (ICT).
- **NSERC/NRCan/AECL Generation IV Energy Technologies Program** - This program, co-funded by NSERC and the Natural Resources Canada (NRCan) Office of Energy Research and Development, in collaboration with Atomic Energy Canada Limited (AECL), supports research initiatives on large-scale reactor technologies. Canadian academic researchers, in collaboration with AECL scientists, may receive grant funds to investigate specific research that support Generation IV Energy Technologies in the area of Super-Critical Water-Cooled Reactors (SCWR).
- **Vanier Scholarships** - To develop and attract the next generation of world-class researchers, a new class of doctoral scholarships named in honour of former Governor General Georges P. Vanier has been created. The Vanier Scholarships program will help attract the best doctoral students from here and around the world to study in Canada. The Vanier Scholarships will build on Canada's existing strength in graduate education and help build the skilled workforce needed to face the challenges of the future.
- **Canada Excellence Research Chairs** – The program's objective is to strengthen the ability of Canadian universities to attract and retain the world's top scientific leaders. These prestigious Research Chairs will be offered in the four priority areas identified in the Government's Science and Technology Strategy; the environment, natural resources and energy; health; and information and communication technologies. Program funding will allow each Chair to assemble outstanding research teams and undertake cutting-edge research in areas of strategic importance to Canada.
- **College and Community Innovation (CCI) Program** - The objective of the CCI Program is to increase innovation at the community and/or regional level by enabling Canadian colleges to increase their capacity to work with local companies, particularly small and medium-sized enterprises (SMEs). The government announced in Budget 2007 that NSERC's pilot CCI program would be extended and broadened.

1.4 Summary Information

NSERC is the primary federal agency investing in research and research training in the natural sciences and engineering disciplines. It is funded directly by Parliament and reports to it through the Minister of Industry.

Our mission is to invest in people, discovery and innovation to build a strong Canadian economy and to improve the quality of life for all Canadians. NSERC advances the government's S&T priorities of building a stronger Canada, creating opportunities for young Canadians and investing in knowledge and creativity.

S&T Strategy

The new Federal Science and Technology (S&T) Strategy, *Mobilizing Science and Technology to Canada's Advantage* was released in May 2007. Through the S&T Strategy, the federal government has committed to maintaining Canada's G-7 leadership in public sector R&D performance. The Strategy builds on existing strengths, focusing efforts in areas where Canada can achieve global excellence, to make a real impact on the lives of Canadians and in the marketplace.

The S&T Strategy emphasizes three Canadian advantages: an entrepreneurial advantage that translates knowledge into practical applications; a knowledge advantage that generates new ideas and builds research excellence; and a people advantage that increases and retains the highly skilled individuals that Canada needs to thrive in the global economy. Together these advantages resonate with the mandate of NSERC and its strategic positioning.

NSERC's focus on **people**, **discovery** and **innovation** maps directly onto the strategy's emphasis of building a **People Advantage**, a **Knowledge Advantage** and an **Entrepreneurial Advantage**. In broad terms, virtually all of NSERC's funding relates to these advantages.

The strategy's principles have been incorporated into NSERC's planning and decision-making functions. These principles are also solidly embedded in NSERC's way of doing business, which includes: a competitive, peer reviewed evaluation system to ensure world class levels of ***excellence*** and value for money; a blend of targeted and broad-based programs to ensure that ***priority*** research topics are addressed as well as a broad spectrum of science, from discovery to applied research and commercialization; a suite of collaborative research programs that foster ***partnerships*** between industry and post-secondary institutions and that encourage commercialization; and appropriate and effective controls that are proven and recognized to ensure ***accountability***.

Figure 2 highlights the financial resources expended by NSERC and Figure 3 presents the expected outcomes by program activity. The evidence presented in Section 2 suggests that all of the 2007-08 results successfully met expectations.

Figure 2
Summary Information for NSERC

Raison d'être:

NSERC works to make Canada a country of discoverers and innovators for the benefit of all Canadians. To achieve this, we invest in people, discovery and innovation in Canadian universities and colleges.

Financial Resources ($ millions):

2007-2008		
Planned Spending	**Total Authorities**	**Actual Spending**
$899.8	$1,015.4	$1,012.5

Human Resources (Full-time Equivalent):

2007-2008		
Planned	**Actual**	**Difference**
319	327	+8

Departmental Priorities:

Name	Type	Performance Status
1. Develop tomorrow's discoverers and innovators	Ongoing	Successfully met
2. Build on Canada's strength in discovery	Ongoing	Successfully met
3. Seize emerging research opportunities	Ongoing	Successfully met
4. Realize the benefits of university research	Ongoing	Successfully met

Figure 3
Program Activities by Strategic Outcome

Strategic Outcome/ Program Activity	Expected Results	Performance Status	2007-08 ($ millions)		Supports Priority
			Planned	Actual	
Strategic Outcome #1: People **Highly skilled science and engineering research professionals in Canada**					
1.1 Promote Science and Engineering	Student interest in research in the sciences, math and engineering is encouraged	Successfully met	$4.1	$4.4	1
1.2 Support Students and Fellows	A supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian industry, government and universities	Successfully met	$136.4	$137.9	1
1.3 Attract and Retain Faculty	Enhanced research capacity in science and engineering	Successfully met	$167.8	$148.0	1, 2
Strategic Outcome #2: Discovery **High quality Canadian-based competitive research in the NSE**					
2.1 Fund Basic Research	The discovery, innovation and training capability of university researchers in the NSE is enhanced	Successfully met	$403.6	$454.3	1, 2, 3
2.2 Fund Research in Strategic Areas	Research and training in targeted and emerging areas of national importance is accelerated	Successfully met	$57.7	$75.4	1, 2, 3, 4
Strategic Outcome #3: Innovation **Productive use of new knowledge in the NSE in Canada**					
3.1 Fund University-Industry-Government Partnerships	Mutually beneficial collaborations between the private sector and researchers in universities, resulting in industrial or economic benefits to Canada	Successfully met	$115.0	$181.8	4
3.2 Support Commercialization	The transfer of knowledge and technology from Canadian universities and colleges to the user sector is facilitated	Successfully met	$15.2	$10.7	4
TOTAL		-	**$899.8**	**$1,012.5**	

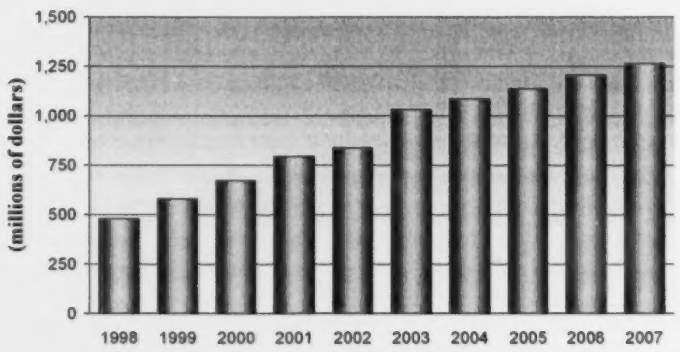
1.5 Summary of Departmental Performance

Before NSERC's departmental performance is described, it is useful to situate NSERC in Canada's and the world's systems of innovation. NSERC's support for research and training is typical of many similar agencies around the world known as "granting councils." Along with the more traditional role of education, universities worldwide have become centres of knowledge creation. In most industrialized countries, universities play a key role in the economic development of the nation. Because of the socio-economic benefits of university education and research, government funding of these institutions and their activities has become the norm.

Funding Environment

Canada's research landscape has changed substantially over the past decade. Federal investment in higher-education R&D (see Figure 4) has increased dramatically over this period. In many areas of research, Canada is truly a world-class player, as demonstrated by its increased ability to attract and retain top talent. The national science and innovation system offers Canadian researchers the tools they need to be knowledge trailblazers, seize opportunities to innovate and address global challenges such as adaptation to climate change and sustainable energy. NSERC is committed to advancing the goals of the S&T Strategy and to helping the research community make the most of the opportunities it offers them.

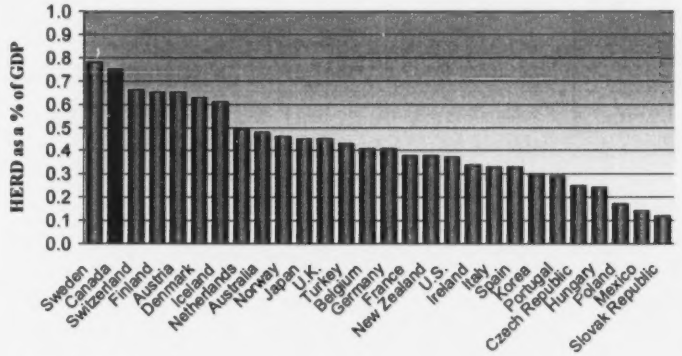
Figure 4
Federal Funding of Higher Education R&D in the NSE



Source: Statistics Canada

In 2006, member countries of the Organization for Economic Co-operation and Development (OECD) spent $168 billion on university research. Canadian university professors and students performed 5.9% of this total. When measured as a percentage of GDP, Canada spends more on university research than all of its G7 competitors and places second among OECD countries, only slightly behind Sweden (see Figure 5).

Figure 5
Higher Education R&D (HERD) as a Percentage of GDP, 2006 or Most Recent Year

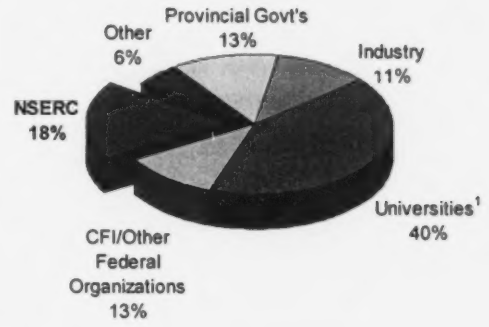


Source: OECD.

In 2007, university research represented 36% of all Canadian research, as measured by expenditures. This percentage is much higher than the OECD average of 18% of R&D performed by universities in member countries.

NSERC is the most important funder of the direct costs of research in the natural sciences and engineering in Canadian universities. In 2007, $4.3 billion was spent on research in the natural sciences and engineering in Canadian universities. NSERC directly provided almost one-fifth of the total funding. Figure 6 gives a breakdown of the total funding by direct source.

Figure 6
University R&D Funding in the Natural Sciences and Engineering, 2007



Total: $4.3 Billion

1. Includes faculty salaries and indirect costs related to research. Excludes related scientific activities (RSA).
Source: Statistics Canada

Nearly 12,000 university professors and more than 26,000 university students and postdoctoral fellows are supported by NSERC. (For a searchable database of all NSERC grant and scholarship recipients see http://www.nserc.gc.ca/funding/funding_dec_e.asp.) NSERC funds are also used to support a considerable number of university technicians and research associates. Most Canadian universities benefit from NSERC programs, as do a growing number of colleges. Canadian industries and government departments are increasingly partnering with NSERC. Figure 7 presents the details of NSERC's support to client communities and partnerships. Estimates of the share of the population of eligible individuals and organizations funded or participating, and trends over the past 10 years, are also included.

Figure 7
NSERC's Clients and Partners, 2007-08

	Number Supported or Participating	Share of the Population[1]	Trends in Share of the Population Over Past 10 Years
Clients:			
University Professors	11,755	75%	Small Increase
Undergraduate Students	9,502	7%	Moderate Increase
Master's/Doctoral Students	14,659	35-40%	Moderate Increase
Postdoctoral Fellows	2,340	40-45%	Small Increase
University Technicians, and Research Professionals	3,504	30%-35%	Moderate Decrease
Partner Organizations:			
Universities and Colleges	93	75%[3]	Small Increase
Companies Performing R&D[2]	1,435	10%	Moderate Increase
Federal Science Departments/Agencies[2]	26	80%	Small Increase
Provincial Science Departments/Agencies[2]	23	25-40%	Small Increase

Source: NSERC

1. The percentage that NSERC supports of all individuals and organizations eligible for NSERC funding.
2. Organizations in partnership with NSERC (across all NSERC programs).
3. Percentage only applies for universities.

As the main beneficiaries of NSERC funding, university professors and students are NSERC's key clients. University administrative offices, such as research and scholarship liaison offices, are key partners in ensuring cost-effective NSERC program delivery. Further downstream, university technology transfer offices assist in generating the socio-economic returns at the core of one of NSERC's desired strategic outcomes. In addition, several NSERC programs require the involvement of industry and/or government partners. Detailed statistics on NSERC applications and awards can be found at: http://www.nserc.gc.ca/about/fact_e.asp.

Given the multitude of partners involved, it must be emphasized that the outcomes presented in Section 2 are shared achievements. There is no easy way to isolate the impact of NSERC funding. However, because NSERC funding is the key driver in the early stages of the process and exercises quality control at that stage through peer review, it is doubtful that many of these outcomes could occur without it.

Departmental Performance

NSERC measures its performance by evaluating its programs of research and training support according to their impact, cost effectiveness and continuing relevance. When reviewing performance of research support programs, it is important to remember that these investments take longer to bear fruit than most other government investments. **The impact of NSERC's investment in research and training in the NSE can be fully assessed only over the long term.** Therefore, the expected results reported in NSERC's Report on Plans and Priorities 2007-08 should be considered as planned results for the future. The performance information presented in this year's DPR is a retrospective look at outcomes resulting from NSERC funding over the past decade, and in some cases even longer.

In recent years, NSERC has been successful in:

- maintaining a strong presence in world science and engineering research by annually supporting nearly 12,000 of the most creative and productive Canadian university professors which are producing an increasing share of world knowledge of high quality;
- supporting the training of tens of thousands of master's and doctoral students, who have found well-paying, productive jobs and who are contributing to Canada's knowledge-based economic sectors by predominantly working in R&D;
- partnering with more than 1,400 Canadian firms to transfer knowledge created in the university sector to private firms that create economic wealth; and,
- supporting the development of new processes and products, some leading to the formation of new companies, all of which contribute significantly to the national economy; and more than off-set the annual investments made by NSERC.

In 2007-08, NSERC also implemented numerous changes to align with the government's *S&T Strategy*, including:

- the effective design and delivery of programs (new and enhancements of existing programs) that reflect the objectives of the S&T Strategy and which are mobilizing the post-secondary research community around the Strategy's priority areas;
- the creation of inter-agency mechanisms that foster a more comprehensive approach to the overall management of research support;
- new partnerships with the business sector, including the rapid launch of new programs such as business-led Networks of Centres of Excellence (NCE);
- enhanced focus on priority areas in new and existing programs with particular attention to initiatives that cross the mandates of the individual funding agencies; and
- strengthening the commercialization, technology transfer, and knowledge translation and mobilization activities of all agencies through internal leadership and program enhancements.

Section 2 – Analysis of Program Activities by Strategic Outcome

NSERC strives to provide Canadians with economic and social benefits arising from the provision of a highly-skilled workforce and knowledge transfer of Canadian and international discoveries in the natural sciences and engineering from universities and colleges to other sectors. The pace of realization of immediate and intermediate outcomes will vary with the research projects and students funded, taking from a few years to decades. This progression is also not risk free, with some research projects and students not realizing their full potential. As well, no one indicator can be used to measure a defining accomplishment; rather a whole suite of indicators must be taken into consideration. In addition, many of the immediate and intermediate outcomes for the three strategic outcomes overlap.

2.1 Highly Skilled Science and Engineering Professionals in Canada

By supporting students and fellows at Canadian universities and abroad, providing programs to support university faculty, and promoting science and engineering to Canadian youth, NSERC will ensure a reliable supply of highly qualified personnel (HQP) for Canadian industry, government, and academia. The following three sections provide details of NSERC's performance by program activity for the strategic outcome of highly skilled science and engineering professionals in Canada.

2.1.1 Promote Science and Engineering

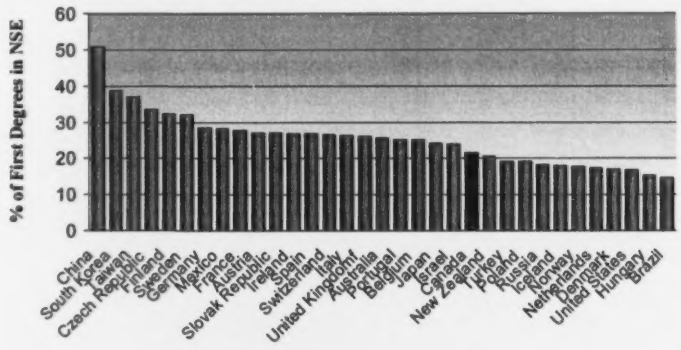
An overview of the "promote science and engineering" program activity is presented below:

Description		**Expected Results**	
This program activity encourages popular interest in science, mathematics and engineering and aims to develop science, mathematics and engineering abilities in Canadian youth.		Student interest in research in the sciences, math and engineering is encouraged	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$4.1M	Non-profit organizations	80
Actual Spending	$4.4M	Universities/Colleges	43
Planned Human Resources	2		
Actual Human Resources	2		

Young Canadians are less inclined to select science or engineering as a discipline when they enter university (see Figure 8) as compared to many other nations. To help improve the interest of Canadian youth in science and engineering, NSERC has launched two

programs. The key programs under this program activity are PromoScience ($2.9M) and the Centres for Research in Youth, Science Teaching and Learning ($1.0M), with the remaining funds spent on science promotion awards and administration.

Figure 8
First Degree Awarded in the NSE as a Percentage of Total First Degrees, 2004 or Most Recent Year



Source: National Science Foundation.

The PromoScience program provides support to non-profit and public organizations that work with young Canadians in order to build their interest in science and engineering, motivate and encourage their participation in science and engineering activities, and train teachers who are responsible for the science and math education of young Canadians. NSERC closely monitors the progress of these grants and reviews final reports to ensure impact. A selection of early outcomes from PromoScience grants is presented in Figure 9. The program is allowing organizations to expand their offerings and to engage many more young Canadians, especially girls and aboriginal youth. A potential indicator of the long-term impact of PromoScience funding can be gauged from an exit survey of NSERC Undergraduate Student Research Award recipients (see Section 2.1.2) in which 30.1% of 13,067 respondents (who are currently enrolled in an NSE bachelor's degree program) took part in science camps or fairs either in elementary school or high school.

Figure 9
Examples of PromoScience Program Impact

Organization Supported		Impact of NSERC Funding
Chuntoh Education Society	The Chuntoh Education Society is a registered charity that provides children and youth with environmental and cultural educational opportunities in a focused and positive outdoor atmosphere.	The society has expanded its suite of cultural programs: • Students learn the links between cultural knowledge and the natural sciences from a variety of activities available in different seasons. • Programs are designed to supplement classroom curriculum. • Cultural science education programs were developed and delivered to 400 youth including 190 First Nations children in the public and First Nation schools in the Fort St. James area.
University of Manitoba / Centre for Earth Observation Science (CEOS)	Schools on Board is an outreach program of ArcticNET hosted by CEOS. It promotes Arctic sciences in high schools across Canada.	NSERC funding has supported the expansion of the educational and outreach potential of the program: • 4,000 students per year are exposed to the field program. • Close to 200 presentations have been given by the student participants from the icebreaker. • Educator's kits developed for school use. • Mentoring opportunities initiated between students and scientists. • Piloted first Arctic Climate Change Youth Forum (250 students and teachers).
Perimeter Institute for Theoretical Physics	Einstein Plus is a highly interactive workshop for high school physics teachers on the topic of modern physics.	The workshop has been very successful: • Teacher participation has increased from 80 to 120. • Additional materials have been produced for teachers to take home as resources.
Tantramar Wetlands Centre	The Tantramar Wetlands Centre is a non-profit organization providing high quality science enrichment opportunities using a wetland as an outdoor classroom.	Educational programs and participation rates have grown: • Five additional experiential science education programs for youth and teachers for all four seasons developed. • Internship positions for high school students provided. • 3,500 Maritime students and teachers participate annually with an annual increase of 10%. • Reach of programs has extended beyond New Brunswick.

2.1.2 Support Students and Fellows

An overview of the "support students and fellows" program activity is presented below:

Description		Expected Results	
This program activity supports training of highly qualified personnel through scholarship and fellowship programs.		A supply of highly qualified Canadians with leading-edge scientific and research skills for Canadian industry, government and universities	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$136.4M	Undergraduate Students	4,190
Actual Spending	$137.9M	Master's/Doctoral Students	4,628
Planned Human Resources	54	Postdoctoral Fellows	683
Actual Human Resources	50		

NSERC provides direct financial support to students from the undergraduate to postdoctoral levels through key programs such as:

- **Undergraduate Student Research Awards ($19.0M)**: Held in university or industry laboratories, this program provides funding for an undergraduate student to spend a four-month work term in a university or industrial research environment. This program is important to help attract the best students to advanced studies and careers in research.

- **Postgraduate Scholarships ($93.6M)**: At the master's and doctoral levels, NSERC supports students by providing an annual stipend that enables them to continue to pursue their research interests. Up to four years of support is available over the course of a candidate's graduate studies. Opportunities for study at institutions in Canada and abroad as well as at Canadian industrial laboratories are available. Canada Graduate Scholarships (tenable only at Canadian universities) are awarded to the most outstanding candidates.

- **Postdoctoral and Industrial R&D Fellowships ($18.9M):** These two-year awards support researchers who have completed their Ph.D., and provides them with funds to continue their programs of research. The awards may be held at any academic institution through a Postdoctoral Fellowship, or at a Canadian company that conducts research through an Industrial R&D Fellowship.

The remaining funds under the program activity were used for the administration of the programs above.

NSERC also funds students and fellows through support provided by an NSERC-funded professor from his or her NSERC grant. More students and fellows are funded through this "indirect" route (17,000) than through the direct scholarships or fellowship awards (9,501) presented under this program activity. General macro-level economic outcomes for university graduates in the natural sciences and engineering provide ample evidence of the positive outcomes for NSERC-funded students, both directly and indirectly supported.

NSERC conducts several surveys of its scholarship and fellowship winners and is able to assess performance against expected results. In addition, Statistics Canada collects labour market information that provides ample evidence of the successful career outcomes of NSE graduates. The following sections present data from both sources for this program activity.

Undergraduate Student Research Awards:

NSERC provides four-month positions for undergraduate students in the natural sciences and engineering through our Undergraduate Student Research Awards (USRA) program (note: NSERC-funded professors also support undergraduate students through their NSERC research grants). NSERC's current annual investment of $19 million in this program brings this experience to nearly 4,200 students every year. Providing these students with valuable experience in a university or industrial laboratory encourages them to undertake graduate studies. This is an important indicator of the impact of the program. Figure 10 provides outcome data from six surveys conducted with USRA recipients involving 13,067 respondents (63.4% response rate). Overall, the program is offering students a high quality training experience and is encouraging a significant number to pursue postgraduate studies in the NSE.

Figure 10
Performance Related to NSERC Undergraduate Student Research Awards (USRA)

Short-term Outcomes	❑ Satisfaction is high with the USRA work experience; ❑ Students report learning practical techniques and methods and gaining critical management skills; ❑ Students report that the supervision and instruction they received was excellent; ❑ Students' interest in research increased at a critical period in their career; and ❑ USRA work experiences had a significant impact on students' interest in careers in industry;
Longer-term Outcomes	❑ Students overwhelmingly believe their USRA job experience will improve their permanent job prospects; and ❑ Nearly 80% of respondents plan to go on to obtain a master's or doctoral degree, and a significant number of students plan to stay in university longer as a result of their USRA job experience.

NSERC Postgraduate Scholarships:

NSERC provides scholarship support for Canadians to pursue master's or doctoral degrees in the natural sciences and engineering. These programs support more than 4,600 students annually at a cost of $94 million per year.

The career status of former NSERC-funded master's and doctoral students and the degree to which NSERC funding affects their ability to undertake or continue with their studies are important indicators of the impact of the scholarship support. Over the past thirteen years, NSERC has completed eleven surveys (three exit surveys – 1,680 respondents/68% response rate; and eight follow-up surveys nine years after the award – 1,850 respondents/49% response rate) of directly-funded master's and doctoral students. Some of the key findings related to the short and longer-term outcomes experienced by these students are highlighted in Figure 11. Virtually all of the training objectives of the program are being met and labour market outcomes for the students, early on in their careers, are very promising.

Figure 11
Performance Related to NSERC Postgraduate Scholarships

Short-term Outcomes	❑ 96% of the respondents completed the degree (master's or doctoral) for which they received NSERC funding; ❑ 46% report that NSERC funding was "very important" to their decision to continue with graduate studies; ❑ Nearly 50% of the students believed that NSERC funding would help them complete their degree faster; and ❑ Average scientific output per student of 1.4 journal publications, 1.2 conference proceedings and 1.2 conference presentations. ❑ More than 300 industrial partners who contributed more than $2M per year to help support nearly 500 students.
Longer-term Outcomes	❑ Graduates experience far less unemployment (approximately 2%) than the national average (approximately 7%); ❑ The vast majority (92%) have found full-time employment. ❑ Incomes are much higher than the Canadian average, with more than 80% earning more than $45,000 a year; and ❑ 69% report their graduate training was "critical" to their current employment.

Postdoctoral Fellowships:

After a doctoral degree, in many of the NSE fields, a significant proportion of graduates go through additional postdoctoral research training. NSERC directly funds postdoctoral fellows (PDFs) for up to two years to continue their research training. NSERC invested $15 million to support 496 Canadian PDFs in 2007-08.

The career status of former NSERC-funded postdoctoral fellows and the degree to which NSERC funding affects their ability to pursue a research career are important indicators of the impact of the postdoctoral support. Over the past eight years, NSERC has completed four surveys (573 respondents/40% response rate) of directly-funded postdoctoral fellows seven years after their award and two exit surveys (150

respondents/65% response rate) after the completion of the award. Some of the key findings from the surveys are presented in Figure 12. NSERC-funded postdoctoral fellows are actively engaged in research and experience the same positive labour market outcomes as postgraduate students.

Figure 12
Performance Related to NSERC Postdoctoral Fellowships (PDF)

Short-term Outcomes	❑ For 90% of PDFs, NSERC funding was moderately to very important in their decision to continue with their research in an academic environment. ❑ Average scientific output per fellow of 3.6 journal publications, 1.8 conference proceedings and 2.1 conference presentations. ❑ The vast majority of PDF holders felt they received adequate supervision. ❑ 97% of respondents felt that their PDF award would improve their prospects of finding employment in a relevant area; and ❑ More than 75% of PDF holders would repeat their decision to pursue a postdoctoral position after their doctoral degree.
Longer-term Outcomes	❑ 57% of PDF holders obtained faculty positions at universities and now train the next generation of scientists and engineers; ❑ The vast majority (87%) are still engaged in research, either as a university professor, research scientist or engineer; and ❑ Almost 75% of PDFs report their postdoctoral training was critical to their careers.

Industrial Research and Development Fellowships:

An important route for doctoral graduates to gain additional research experience is through NSERC's Industrial R&D Fellowships (IRDF) program. The program currently invests approximately $4 million per year to help place 150-200 Canadian Ph.D.s annually in industrial laboratories. This investment has contributed significantly to the number of doctoral graduates working in Canadian industrial labs. More than 20% of Canadian industrial researchers with a Ph.D. have been funded by NSERC through the IRDF program. To determine if the program is staying on track, NSERC routinely monitors the employment situation of former IRDF winners. Some key findings are presented in Figure 13.

Figure 13
Performance Related to NSERC Industrial R&D Fellowships (IRDF)

Short-term Outcomes	❑ 98% of the firms said that the program was able to meet their requirements. ❑ 98% of the firms stated that the research project undertaken by the fellow was "successful"; and ❑ 94% of the firms believed the research project undertaken was cost-effective. ❑ 75% of former IRDF winners are still working in Canadian industries. A small percentage have gone on to academic positions in Canadian universities and a similar percentage have left the country.

ECONOMIC ANALYSIS

The highlights of a recent economic analysis of NSERC's student and fellowship support conducted by Torben Drewes, a professor of economics at Trent University, are shown below.

The social benefits produced by investments in postsecondary education in NSERC-related fields of study exceed the social costs by a significant margin. The essential question asked is whether NSERC's annual expenditures on student support represent a good investment of public funds. The answer to that question depends on a critical, but unknown, piece of information: how many more students undertake postgraduate education because of that support? In the absence of that information, the analysis inflates the annual flow of pre-tax incomes (which represent the productivity profiles of individuals with different levels of education) to incorporate the external social benefits of enhanced productivity of other workers, lower crime rates, and so on. Social costs in the form of instructional expenditures are factored in. The differences between the social benefits and costs between bachelor's and master's graduates, and between master's and Ph.D. graduates represent the annual social benefit flows from investments in master's and in Ph.D. programs, respectively. These benefits are then discounted at a rate of 2.5% to determine the capitalized, or present, values. It is then possible to estimate the total social benefit produced at different assumptions about the number of students induced by NSERC funding to continue their studies.

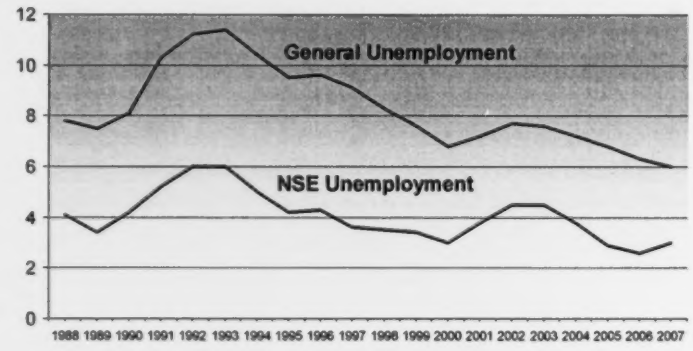
The analysis indicate that if only 1,000 master's and 1,000 Ph.D. students were influenced in enrolling in graduate programs because of NSERC funding, NSERC scholarship programs will more than pay for themselves in net social benefits produced since NSERC funds more than 14,000 master's/doctoral students. It would seem reasonable to assume that NSERC- induced participation is at least as high as that.

LABOUR MARKET OUTCOMES

Since 1978, NSERC has supported the training of more than 75,000 master's and doctoral students in the NSE. These graduates are major contributors to knowledge creation and technology transfer in Canada. Surveys of NSERC-funded students early in their careers indicate extremely positive employment outcomes.

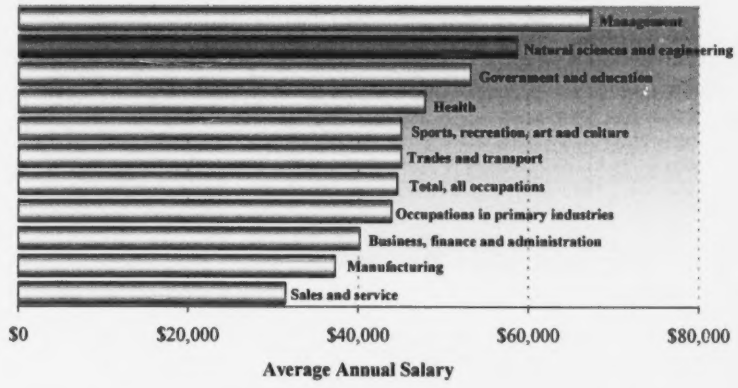
These results are not surprising given the strong demand for natural science and engineering graduates. Unemployment levels for persons seeking work in natural science or engineering occupations are considerably below national levels (see Figure 14) and annual salaries for this group are nearly 32% greater than the national average (see Figure 15).

Figure 14
Unemployment Rate (%) for Natural Scientists and Engineers (NSE)



Source: Statistics Canada

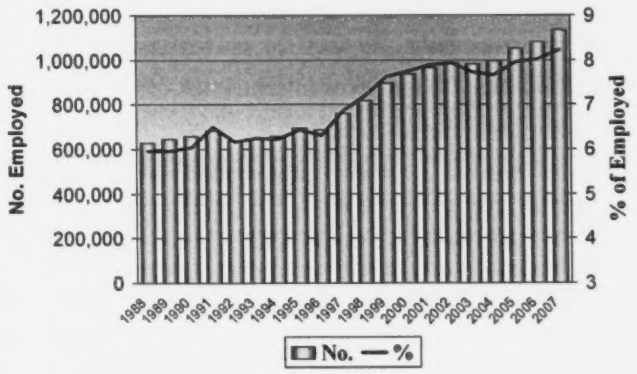
Figure 15
Average Annual Salaries by Occupation in Canada, 2007



Source: Statistics Canada. Full-time employment.

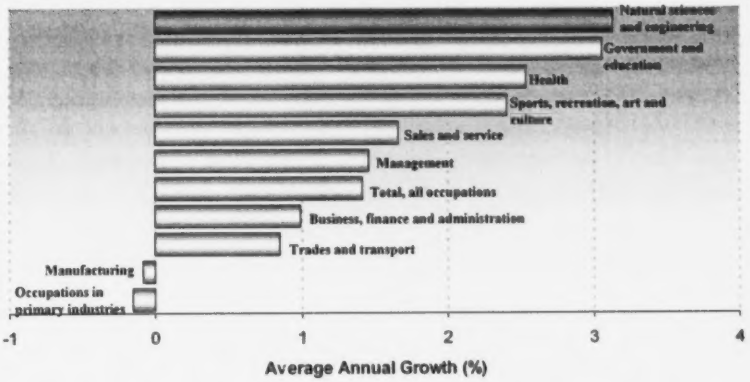
NSERC-funded graduates are now part of a growing natural science and engineering labour force of more than 1,000,000 people (see Figure 16). As the knowledge economy continues to grow in Canada, employers will hire increasing numbers of NSE graduates, as they have in the past (see Figure 17). As also shown in Figure 17, natural science and engineering positions have been the fastest growing occupational group over the past 20 years.

Figure 16
Number of Workers in Natural Science and Engineering Occupations in Canada (Professional and Technical)



Source: Statistics Canada. Full-time employees.

Figure 17
Average Annual Growth in Occupations in Canada 1988 to 2007



Source: Statistics Canada. Full-time employment.

2.1.3 Attract and Retain Faculty

An overview of the "attract and retain" program activity is presented below:

Description		Expected Results	
This program activity aims to attract and retain faculty at Canadian post-secondary institutions. It includes a number of Chairs programs that strengthen research excellence and teaching at Canadian universities by providing support for faculty in specific fields.		Enhanced research capacity in science and engineering.	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$167.8M	Professors	1,062
Actual Spending	$148.0M	Undergraduate Students	279
Planned Human Resources	23	Master's/Doctoral Students	454
Actual Human Resources	21	Postdoctoral Fellows	239

Key programs under this program activity include:

- **Canada Research Chairs ($115.9M)**: This Tri-Council (NSERC, CIHR and SSHRC) program provides financial support for up to 2,000 professors across Canada, including 846 positions in 2007-08 within the NSE. The key objective of this program is to enable Canadian universities to achieve the highest levels of research excellence and to become world-class research centres in the global knowledge-based economy.

- **Industrial Research Chairs (IRC), Other Chairs and Faculty Support Programs ($27.7M)**: The IRC program helps universities build the critical mass of expertise and long-term relationships with corporate partners in areas of research that are of importance to industry. Industrial Research Chairs can also enhance the ability of universities to recruit senior-level researchers and research leaders from industry or other sectors.

  Support of university faculty in targeted areas such as Northern Research, Management of Technological Change, Fuel Cells, Design Engineering, and Women in Science and Engineering helps address specific needs in particular disciplines.

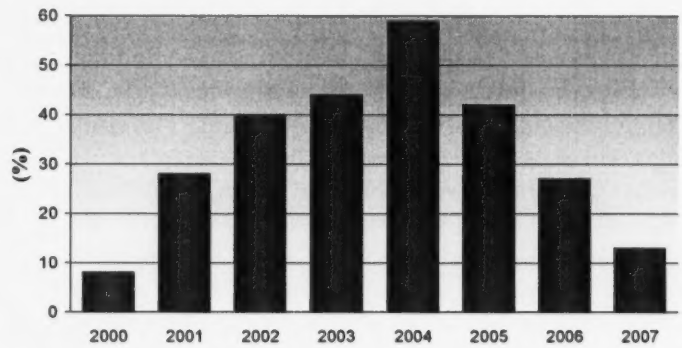
- **Prizes ($2.1M)**: NSERC prizes recognize outstanding individual Canadian researchers, research teams and students. They enhance the career development of outstanding and highly promising scientists and engineers and distinguish the sustained excellence of faculty members at Canadian universities. They also publicly recognize lasting partnerships in R&D between university and industry and celebrate young Canadian entrepreneurs.

The remaining funds under the program activity were used for administration of the programs above.

By far, the largest program of this program activity is the Canada Research Chairs program. The first awards were made in 2000-01 and by 2007-08 the program supported nearly 850 positions in the natural sciences and engineering in universities, and almost 1,000 in other disciplines. A fifth year evaluation of the program was recently completed (the evaluation was for all disciplines and a copy of the report can be found at: http://www.chairs.gc.ca/web/about/publications_e.asp).

The Canada Research Chairs program has helped to create a research environment that is conducive to the long-term retention and attraction of top researchers. A significant number of Chairholders has been attracted from outside Canada and many top Canadian scientists have stayed in the country as a result of Chair support. Figure 18 presents the distribution of Chair awards in the natural sciences and engineering since the program's inception.

Figure 18
Canada Research Chair (NSERC) Recruitment from Abroad by Year (% of Chairs)



Source: Canada Research Chair Secretariat.

Industrial Research Chairs

An evaluation of NSERC's Industrial Research Chairs (IRC) program was conducted in 2006-07. Key findings from the evaluation indicate a strong impact on Chairholders and universities in terms of enhanced research capacity and building critical mass. Partners

are also benefitting immediately through more unfettered access to longer-term research and specialized expertise with opportunities to share costs and risks associated with conducting longer-term research. More detailed evaluation findings are as follows:

- The majority of partner respondents reported the strongest impacts with respect to increased access to specialized expertise and research results. These impacts are consistent with the partners' expectations of the IRC program. Ongoing access to the Chairholder's expertise was considered to benefit the partner organizations by facilitating the transfer of knowledge/technology with respect to cutting edge research, and potential new processes, products and methodologies for exploring research problems. Moreover, the Chair, through its network of collaborations, provides the partner organization with access to expertise beyond the Chair.

- Survey evidence shows that IRC research is being used by industry, most commonly to improve or develop processes and products (see Figure 19). Additionally, other receptor organizations typically use research results. A comparison of earlier and more recent Chairs revealed that, with the exception of prototype or pilot development, a greater percentage of the earlier Chairs showed evidence of transfer of knowledge/technology (e.g. increases in the number of patents issued, numbers of technologies licensed, and improved and new processes and products) indicating that commercialization of results is being realized over time.

- The IRC program plays a strong role in strengthening existing partnerships and in creating new partnerships between industrial partners and universities. Sixty-seven (67) percent of industrial partner respondents reported that the existing partnerships with universities have been strengthened as a result of the IRC program. Forty-two (42) percent of all partner respondents reported that their organization had formed new partnerships with university researchers and 31 percent reported that they had formed new partnerships with other organizations as a result of the IRC.

- The IRC program was reported to contribute significantly to the achievement of critical mass and helped to bridge gaps in existing programs or developed niche areas (e.g. automotive sector, environmental science, construction engineering and management). The building of critical mass in industrially relevant areas was linked to a number of the program's features and benefits such as its leveraging effect, its effectiveness as a tool to recruit and retain faculty (through salary support and increased prestige), and its ability to attract HQP.

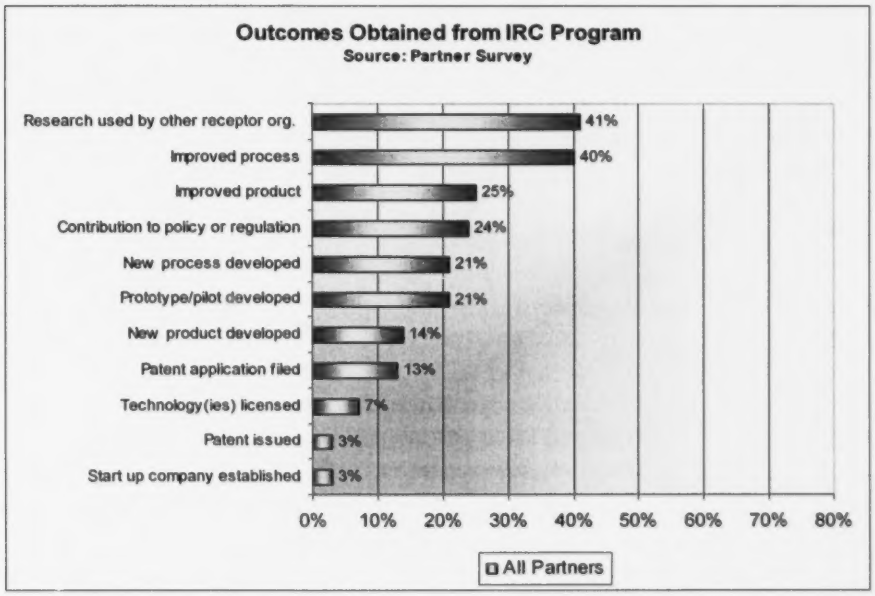
- About one-third of industrial partner respondents indicated that they have hired HQP from the program. Survey results indicated that more than two-thirds of

HQP who obtain employment are employed by industrial partners and industry upon completion of their involvement with the IRC.

- All lines of evidence supported the assertion that the Chair program contributed substantially to the Chairholder's research capacity in terms of increased size of research team, increased ability to attract more qualified personnel, enhanced reputation within the research community, and increased visibility of the research program with industry in general. There was also strong consensus that research was strongly impacted by the IRC program in terms of increased productivity and in terms of an expansion of the research scope.

- According to case study evidence, collaborations with industry also benefit the Chairs and their research in the following ways: by helping them to keep informed of industrial needs and context; by helping to identify fundamental, long-term research objectives; by providing data for future research and development; by providing a "testing-ground" for tools and knowledge; and by providing feedback on the results of the research.

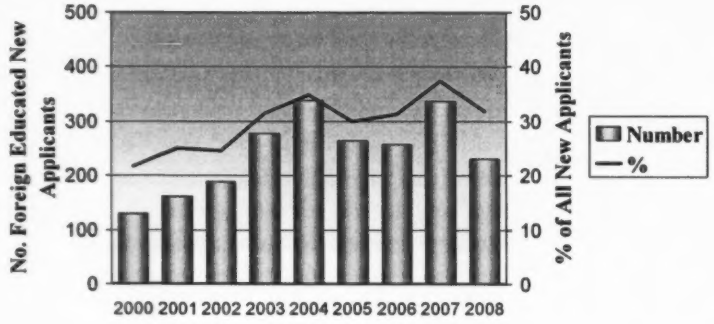
Figure 19
Knowledge and Technology Transfer (Partner Survey) – IRC Program



Attraction/Retention of Faculty

Other evidence of outcomes related to the attraction/retention of faculty comes from NSERC corporate data. Although NSERC does not collect the citizenship history of its applicants, a reasonable guess at citizenship can be made through the education history of applicants. Figure 20 presents the number of new applicants to NSERC's largest program, the Discovery Grants program, who received both their bachelor's and Ph.D. degrees outside the country (this program is a good proxy for an overall evaluation of the "attraction" activity since the vast majority of new professors in the natural sciences and engineering apply to the program). As the figure indicates, Canadian universities continue to attract hundreds of foreign educated personnel every year to become professors. More than 30% of the large number of first-time NSERC applicants are foreign educated. Recent investment by the government in university research has created an attractive environment to conduct research and seems to have attracted the attention of highly trained people from other countries.

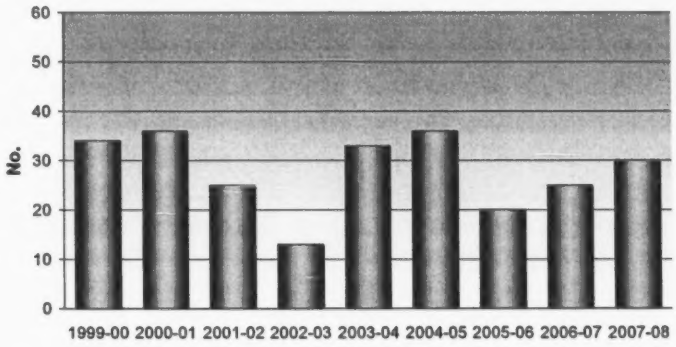
Figure 20
Number of Foreign Educated[1] New Applicants to NSERC's Discovery Grants Program



1. Applicants who earned both an undergraduate and Ph.D. degree outside Canada.
Source: NSERC.

NSERC also tracks the reasons grantees provide when they terminate their awards before the end date. As shown in Figure 21, only a small number of professors receiving NSERC support listed "leaving the country" as their reason for terminating their award over the past eight years. The number of NSERC-funded professors leaving the country is an extremely small percentage of the nearly 12,000 professors receiving NSERC support.

Figure 21
Number of NSERC-Funded Professors Leaving the Country



Source: NSERC.

The strong federal support of the granting councils and the Canada Foundation for Innovation (CFI) since 1997-98 (see Figure 4), and the increased support for research from provincial governments have dramatically improved the research environment on university campuses across the country. The success witnessed above in the attraction and retention of faculty cannot be attributed to any one program and has resulted from system-wide investments.

To recognize the important achievements of Canadian research scientists and engineers, and, in the process, to help retain faculty in Canada, NSERC awards significant research prizes to individuals and teams. The 2007-08 winner of NSERC's Gerhard Herzberg Canada Gold Medal for Science and Engineering is highlighted below.

John C. Polanyi
Winner of NSERC's Gerhard Herzberg Canada Gold Medal for Science and Engineering

A chemist at the University of Toronto has claimed the Gerhard Herzberg Canada Gold Medal for Science and Engineering, Canada's most prestigious science prize. Named for Canadian Nobel laureate Gerhard Herzberg, the annual prize guarantees the winner $1 million in research funding over the next five years.

Polanyi's natural curiosity and approach to science have led to a number of major advances in chemistry over the years. Most notably, he helped pioneer the development of a new field known as reaction dynamics. This method of study takes chemical reactions down to the molecular level in an effort to understand what happens during a reaction. His contributions to this field earned him a share of the 1986 Nobel Prize for Chemistry.

In addition to the Nobel, Polanyi has been awarded numerous scientific prizes and honorary degrees from universities around the world. He is a Companion of the Order of Canada and a Fellow of the Royal Societies of Canada, London and Edinburgh.

Polanyi's distinguished career touches on more than just pure science. He has published numerous articles on science policy, on the control of armaments and the impact of science on society. He was the co-founder and first Chair of the Canadian Pugwash Group, part of an international movement dedicated to understanding the social impact of science and preventing its misuse.

2.2 High Quality Canadian-Based Competitive Research in the NSE

Basic research provides the foundation for all scientific and technological advances, and also trains the people who can generate new knowledge in Canada and understand new knowledge generated around the world.

2.2.1 Fund Basic Research

An overview of the "fund basic research" program activity is presented below:

Description		**Expected Results**	
This program activity invests in discovery through grants focusing on basic research activities. Basic research provides the foundation for advances in all disciplines within the NSE, and also trains people who can generate new knowledge in Canada.		The discovery, innovation and training capability of university researchers in the NSE is enhanced.	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$403.6M	Professors	10,685
Actual Spending	$454.3M	Undergraduate Students	3,800
Planned Human Resources	127	Master's/Doctoral Students	6,678
Actual Human Resources	143	Postdoctoral Fellows	748

Key programs under this program activity include:

- **Discovery Grants ($333.4M)**: This program is the mainstay of support for university-based research. The program provides funding for ongoing programs of research. Researchers are free to work in the mode most appropriate for the research area and they may pursue new research interests provided they are within NSERC's mandate. To be funded, they must demonstrate both research excellence and high productivity, and contributions to the training of HQP. The discovery, innovation and training capability of university researchers in the NSE is enhanced by the provision of support for the direct costs of ongoing programs of research.

- **Research Tools and Instruments Grants (RTI) ($40.8M)**: CFI funding enhances the laboratory setting by funding major equipment and infrastructure purchases. RTI grants enable professors to purchase the smaller pieces of laboratory equipment necessary to conduct world-class research. This critical source of funding ensures researchers have access to the modern research tools required to ensure the maximum return on other investments in research, such as Discovery Grants.

- **Major Resources Support (MRS) ($35.2M)**: The MRS program supports researchers' access to major regional or national research facilities by assisting these facilities to remain in a state of readiness for researchers to use. This program is the vehicle for NSERC investments in facilities such as the Canadian Light Source synchrotron in Saskatoon and the Sudbury Neutrino Observatory.

- **Special Research Opportunity (SRO) Grants ($10.6M)**: These grants enable researchers to seize new and emerging research opportunities in a timely fashion and develop new collaborations necessary to respond to national and international opportunities.

Other programs under this program activity include funding for the Government of Canada's Program for the International Polar Year ($12.1M), Research Capacity Development in Small Universities ($2.2M), and General Support ($1.3M) and funding for the administration of all of the above programs.

Section 2.1.2 provided a broad perspective on student outcomes for undergraduate and postgraduate students in the natural sciences and engineering. For the remainder of this section, highlights of performance measures related to research funding will be presented. The outcomes presented also capture performance from most of NSERC's other grants programs. As mentioned, it is very difficult to disentangle broad performance measures by NSERC program.

International Review

In 2007-08, a special International Review of the Discovery Grants program was conducted by a prestigious committee of scientists and engineers. The committee came to the following conclusions (the full report can be found at http://www.nserc.gc.ca/about/rep_sur_e.asp).

- The relatively high success rates of Discovery Grants program applications is not incompatible with, and in fact encourages, a high degree of research excellence across a broad range of fields.
- The best researchers are able to use the support of a Discovery Grant as a base to lever an internationally competitive level of funding from other sources.
- The broad base of Discovery Grants program funding sustains an important level of research capability and student training across the NSE disciplines and throughout Canada, and thus contributes significantly to meeting the nation's needs for research results and highly-qualified people.
- The Discovery Grants program is therefore an exceptionally productive investment and thus deserves additional funding to ensure that the value of its grants keeps pace with the growing opportunity.

What follows are some indicators demonstrating the excellence and productivity of Canadian researchers.

Discovery Accelerator Supplements

In 2007-08, NSERC launched a new initiative, targeted accelerator supplements, to provide substantial and timely additional resources to a small group of outstanding researchers, the majority working in the three S&T Strategy priority areas to accelerate progress and maximize the impact of their program. Through peer review, NSERC identified 41 top researchers in the three S&T Strategy priority areas whose research efforts could be dramatically accelerated by an infusion of $40K per year over three years.

Knowledge Advantage Indicators

One of the first tangible outcomes of an investment in university R&D is a publication in a scientific or engineering journal. The worldwide culture of university research places a great deal of importance on publishing new discoveries and advances in widely-circulated journals. Investment in this very public forum gives the country's researchers access to the latest international research and the ability to build on this research. Since the vast majority of Canada's scientific and engineering publications are produced by university researchers, publications are a good indicator of the immediate outcome from NSERC research funding and can be used to benchmark our performance against the rest of the world.

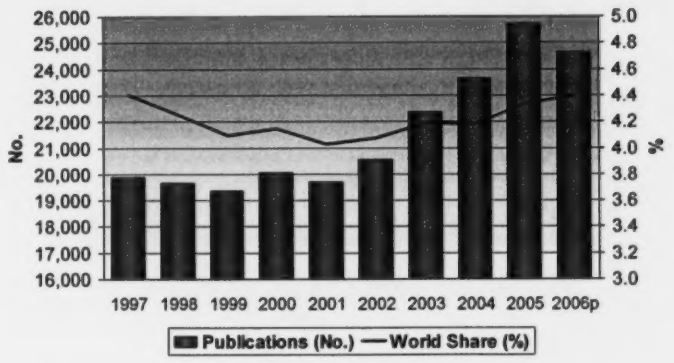
In a previous comprehensive study of publications it was determined that NSERC-funded professors are by far the major contributors to Canada's science and engineering publication output. For this reason, the review of national output as follows can be correlated to NSERC-funding.

Canada is among an elite group of countries publishing a significant number of articles in science and engineering journals. Canadian researchers (all sectors) in the natural sciences and engineering (NSE) have increased their annual production of publications from roughly 20,000 per year to current averages of approximately 25,000 publications per year, as shown in Figure 22. Overall, Canada's world share of NSE papers stood at 4.4% in 2006. Canada's performance in NSE article production versus many of our major competitors has been similar, as most industrialized countries lose publication share to countries such as China, South Korea and Spain. It appears that the upswing of Canada's publications and world share of publications are the first signs of the impact of the additional investments in university research over the past several years.

World article production in the NSE has averaged roughly 600,000 articles per year, with a significant increase in 2003 as more journals were included in the dataset. The U.S. dominates publication production with nearly one-third of NSE articles in any given year.

Canada ranked in 7th position in 2006 improving from its 9th place showing in 2001 to 2003. Canada's world rankings by discipline ranged from 6th spot for biology and earth and space sciences to 12th position in chemistry and physics.

Figure 22
Number of Canadian Publications in the NSE and World Share



Source: Observatoire des sciences et des technologies

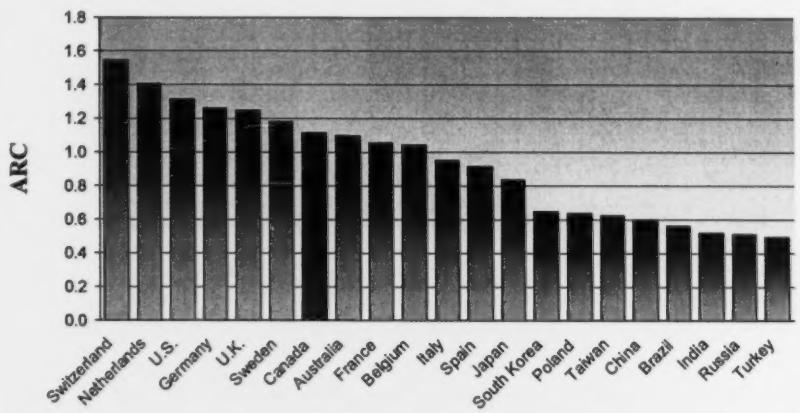
Similar to common rating systems, in which a higher score indicates more viewers, listeners or readers, citations are a measure of the potential use of a researcher's work by fellow researchers. If a researcher's work is being referenced or cited more often by his/her peers, then there may be more intrinsic value to the work. Based on the number of citations received by papers over the three years following the publication year, a standardized measure called the Average Relative Citation Factor (ARC) is then calculated for each country and field and normalized to 1.0. An ARC value above 1.0 for a country and field means that, on average, the country's publications in that field are cited more often than the world average. An ARC value below 1.0 would mean that a country's publications in a field are not cited as often as the world average.

Figure 23 presents the ARC values for countries publishing more than 5,000 articles in the NSE in 2006. Canada's ARC in the NSE ranks 7th and is in a tight grouping with the G7, and only significantly behind the top four countries (Switzerland, Netherlands, U.S. and Germany).

Publishing in the top journals in a scientific field is a potential indicator of excellence and a complementary indicator to the average relative impact factor. *Science* and *Nature* are

two journals in the natural sciences that are very selective, highly influential and widely read. Canadian researchers were authors on more than 6% of articles appearing in *Science* and *Nature* in 2007 while producing 4.4% of total publications.

Figure 23
Average Relative Citation Factor (ARC) in the NSE, 2006

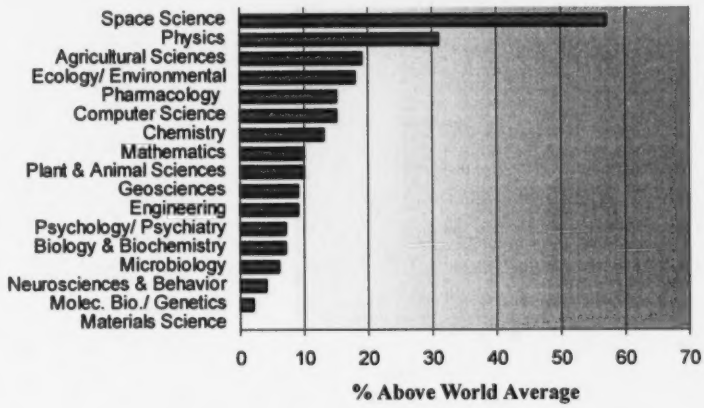


Sources: Observatoire des sciences et des technologies. Only includes countries with at least 5,000 publications in the NSE in 2006.

Figure 24 highlights, for the most recent time period: 2002-2006, the ratio of a country's world share of citations in a particular subfield to the country's world share of publications in that subfield. For example, the percentage of citations to Canadian space science publications exceeded Canada's world production of space science papers by 57% in 2002-2006. Canada is only one of three countries to have a positive relative citation impact for all subfields of the NSE.

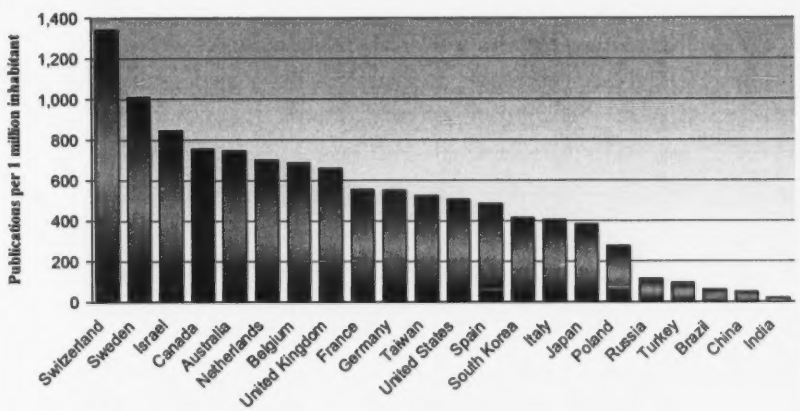
Indicators of productivity as they relate to scientific publication production can also be useful. One indicator is a measure of a country's output of NSE publications per capita population. Figure 25 presents the 2006 per capita output per one million inhabitants for those countries producing a significant number of articles (the cut-off chosen was at least 5,000 articles published in 2006). Using this criterion, Switzerland has the highest per capita output while Canada ranks in 4th position, and ahead of some significant players such as the U.K., France, Germany, United States, Japan and Italy.

Figure 24
Canada's Relative Citation Impact for Select Subfields, 2002-2006



Source: Thompson ISI. Sci-Bytes.

Figure 25
Per Capita Output of Publications in the NSE, 2006



Sources: Observatoire des sciences et des technologies, OECD, 2006 CIA World Fact Book.
Only includes countries with at least 5,000 articles in the NSE in 2006.

The published research findings funded by NSERC are recognized as significant contributions to world science and engineering. A sample of significant research findings funded by NSERC in the areas of the environment, energy, information and communication technologies, and health are highlighted in Figure 26.

Figure 26
Sample of Important Discoveries of 2007-08 Funded by NSERC

	What	*Where*	*Who*	*How*
Environment	**Island nations' fisheries unsustainable**	Simon Fraser University	Dr. Isabelle Côté	Dr. Côté and colleagues studied 49 island countries and found fish catches are, on average, 64% above sustainable levels. In nine of the countries, fisheries have already collapsed.
	Results of 24-year study in the Arctic	Queen's University and University of Alberta	Dr. Marianne Douglas and Dr. John Smol	Drs. Douglas and Smol have been monitoring 40 shallow ponds in the Arctic for the last 24 years. Their studies show that climate change is responsible for alarmingly low water levels. Some lakes which had been around for thousands of years have already evaporated.
	Fish populations affected by "The Pill"	University of New Brunswick	Dr. Karen Kidd	Dr. Kidd was part of a seven-year Fisheries and Oceans study which found minnow populations in an experimental lake began to collapse after prolonged exposure to small amounts of synthetic estrogen. Male fish began producing egg proteins and early stage eggs were found in the testes of some fish.
Energy	**Breakthrough in hydrogen storage**	University of New Brunswick	Dr. Sean McGrady	Dr. McGrady's team successfully condensed hydrogen gas into a usable solid under mild conditions. At the moment, hydrogen gas is typically stored under pressure in large, metal cylinders, which are heavy and expensive to transport. Since they're under pressure, they also pose a safety hazard.

Figure 26
Sample of Important Discoveries of 2007-08 Funded by NSERC (cont'd)

	What	*Where*	*Who*	*How*
Information and Communications	**Sudoku has practical mathematical applications**	Queen's University	Dr. Ram Murty and Dr. Agnes Herzberg	Analyzed the game from a math perspective. Using graph theory, the researchers found the theory behind Sudoku could be used to optimize communications networks and airline schedules.
	Solar activity responsible for dropped cellphone calls	Queen's University	Dr. David Thomson	While investigating communications satellite failures in the 1990s, Dr. Thomson discovered that satellites and cell phones responded similarly to changes in solar gravity modes. He continued to study this phenomenon as it related to dropped calls. By comparing solar flare activity with records of dropped cell phone calls, he was able to show a definite correlation. His next step is figuring out how this occurs.
	Wireless device to record radiation levels	Carleton University	Dr. Atif Shamim and Dr. Muhammad Arsalan	Invented a small, disposable wireless device to monitor the amount of radiation in a patient's body. The invention won a $6,000 prize at the Canadian Microelectronics Corporation TEXPO in 2007.
Health	**Developed virtual scoliosis surgical software**	École Polytechnique de Montréal	Dr. Carl-Éric Aubin	Dr. Aubin's pre-operative surgical simulation tool will allow surgeons to test the effects of scoliosis operations before they operate and plan which implants to use in order to obtain optimal correction.
	Better radiation treatment	University of Windsor	Dr. Chitra Rangan	Dr. Rangan uses mathematical algorithms so a computer can pinpoint a tumour in a patient's body scan and target the radiation without damaging other organs.
	Trans fat-free shortening	University of Guelph	Dr. Alex Marangoni	Developed a trans fat-free shortening, known as CoaVel, which is now baked in eight different cookies by Tasty Selections and sold to Canadian hotels.
	Weightlifting makes old muscles new again	McMaster University	Dr. Mark Tarnopolsky	Found resistance exercise for people 65 and older can actually reverse the effects of aging on skeletal muscles.

Awards and prizes are another measure of excellence in the research community. NSERC collects and updates data on 191 international awards and prizes annually. Over the past 10 years. NSERC-funded professors have received more than 150 of the awards and prizes included in the analysis. One example of a prestigious prize won by an NSERC-funded researcher is shown below.

Dr. Ted Sargent
$10 million grant from King Abdullah University of Science and Technology, KAUST, in Saudi Arabia

Dr. Ted Sargent, a professor of electrical and computer engineering and Canada Research Chair in Nanotechnology will receive a $10 million grant from KAUST, an international graduate-level research university set to open in September 2009.

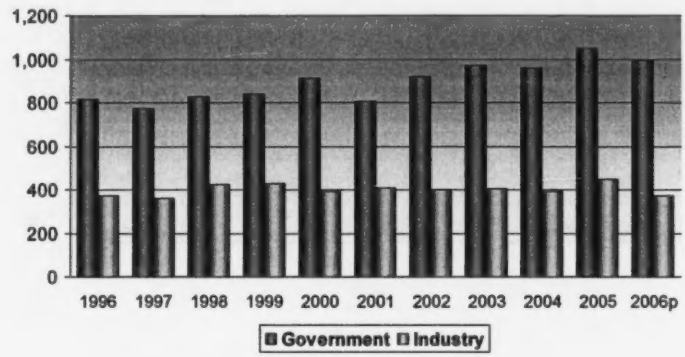
The competition was open to all internationally recognized scientists and engineers having an outstanding record of prior accomplishments and a very high level of originality and productivity. Dr. Sargent, one of the most celebrated scientists of his generation, was the only person at a Canadian university to receive a grant.

Working at the University of Toronto, Dr. Sargent has developed nanotechnology that uses the infrared rays of the sun to provide power for virtually everything that now uses electricity. He has also brought nanotechnology to a wide audience with his popular book, *The Dance of Molecules*.

Knowledge dissemination occurs through virtually every NSERC program. The new knowledge created by NSERC-funded university professors is often used by researchers in Canadian industry and government laboratories. One of the first indications of this dissemination to users is through collaborative publications. Figure 27 indicates that over 800 university-government publications and, on average, 400 university-industry publications are produced annually. This trend has been fairly steady over the past decade, although the downturn in Canadian industrial R&D in recent years has had an impact on the number of university-industry collaborative papers.

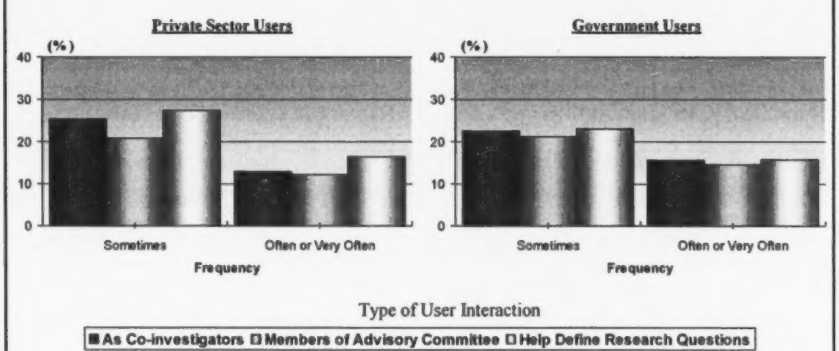
In 2007, NSERC conducted a survey of NSERC-funded professors (2,590 respondents/45% response rate) to gauge their activities in terms of knowledge dissemination to users (industry and government) and knowledge transfer/commercialization. Figure 28 highlights the percentage of the survey respondents who carried out research with industry or government partners in the last five years, or involved users in helping set the direction of their research programs. A large percentage of the respondents participated in this type of collaborative R&D, ensuring quick knowledge dissemination to users.

Figure 27
Number of University-Industry and University-Government Publications with NSERC-Funded Professors



Source: Observatoire des Sciences et des Technologies, NSERC estimates.

Figure 28
NSERC-Funded Professors' Interaction with Users
(Users = Private Firms and Government)



Source: NSERC researcher survey 2007.

Also from the survey, Figure 29 presents the frequency with which NSERC-funded professors took user needs into consideration when planning their research projects, and the frequency with which NSERC-funded professors performed services for private firms related to their research. To some degree, the majority of professors took into account the needs of users in planning their projects. It must be noted that not all research, especially basic research, has clearly-defined users or applications. Although the majority of respondents engage in a variety of knowledge-dissemination efforts, a minority do not. Improving knowledge dissemination to potential users will be an important goal for NSERC and future surveys will monitor the situation. From the previous knowledge transfer survey (conducted in 2000), respondents mentioned many impediments to knowledge transfer to users. Nearly half of the respondents mentioned lack of expertise of users, lack of firms in the region, lack of academic rewards for dissemination and the pressure to publish as various obstacles to knowledge dissemination.

Figure 29
Planning Knowledge Dissemination Activities to Users (Private Firms and Government) and Knowledge Dissemination Activities to Private Firms

Dissemination Activity by NSERC-funded Professors	Never or rarely (%)	Sometimes (%)	Often or very often (%)
Dedicated time for disseminating research results	14.5	23.8	61.7
Identified what part of their research results they want to disseminate to users	27.0	25.2	47.8
Identified individuals or organizations that could benefit by applying the research results	29.4	31.1	39.6
Dedicated financial resources for disseminating research results	35.0	26.5	38.5
Dissemination Activity to Private Firms by NSERC-funded Professors	**Never or rarely (%)**	**Sometimes (%)**	**Often or very often (%)**
Sent my research results directly	49.4	29.8	20.9
Sent technical reports	50.8	28.4	20.8
Gave presentations in a technical seminar organized by the firm	53.0	27.9	19.0
Presented my research results to private firms who could make direct use of them	55.0	27.2	17.8

Source: NSERC Researcher Survey 2007

Recent Evaluations

An evaluation of NSERC's Research Tools and Instruments (RTI), and Major Facilities Access Grants (currently called the Major Resources Support (MRS) program) programs was conducted in 2006-07. Some of the major findings from the evaluation are presented below:

- RTI funding leads to more, faster and more in-depth research as well as better trained HQP. These impacts were felt across the spectrum of disciplines, in all regions and in large and small institutions. Small institutions tended to report benefitting more from RTI funding than larger institutions — as long as they were able to secure such funding since data have shown that the probability of funding was less for small institutions than for medium-sized and large institutions. These observations support the notion that the RTI program is achieving its objectives to enhance the discovery, innovation and training capability of university researchers.
- Three key messages from this evaluation study were:
    - a significant proportion of the existing equipment infrastructure will require replacement over the coming five years — between one quarter and one third of the value of existing equipment is at play;
    - about 20% of existing equipment will require major maintenance over the coming five years; and
    - it is difficult for researchers to find funding for small equipment.
- Due to the amount and nature of the equipment funding, there is currently little overlap between NSERC's RTI program and Canada Foundation for Innovation (CFI) grants. In fact, constraints to usage of CFI (large-scale, state-of-the-art projects within university strategic priorities) make unlikely a dramatic overlap in financial support with RTI/MFA/MRS projects. The current MRS program complements CFI funding on several projects (e.g., Canadian Light Source) by providing the necessary operating and research support to fully utilize the facilities.
- The key impacts of the MFA (now called MRS) program were identified as better use of the facilities, increased collaboration among researchers and improved international competitiveness of Canadian researchers. Effects of a grant appear more intense for MFA projects than for RTI projects — be they the positive effects of obtaining a grant or the negative effects of not obtaining one. Increased collaboration among researchers and organizations as well as attraction and retention of faculty are much more prominent effects for MFA than RTI.

2.2.2 Fund Research In Strategic Areas

An overview of the "fund research in strategic areas" program activity is presented below:

Description		Expected Results	
This program activity funds project research of national importance and in emerging areas that are of potential significance to Canada. By creating linkages between university, industry and government, and addressing areas of strategic importance to Canada, this funding ensures Canadians reap the benefits of their investments in research.		Research and training in targeted and emerging areas of national importance is accelerated.	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$57.7M	Professors	1,446
Actual Spending	$75.4M	Undergraduate Students	434
Planned Human Resources	28	Master's/Doctoral Students	1,091
Actual Human Resources	33	Postdoctoral Fellows	263

The key program under this program activity is:

- **Strategic Project Grants ($67.0M)**: This program accelerates research and training in targeted and emerging areas of national importance. The research is early-stage with the potential to lead to breakthrough discoveries. The program target areas coincide extremely closely to the government's current priority areas of the environment, energy, information and communications technologies, manufacturing, automotive applications, forestry, fisheries, and health.

Other programs under this program activity include funding for the Collaborative Health Research Projects ($3.3M), Innovation Platforms ($1.1M) and funding for the administration of all of the above programs.

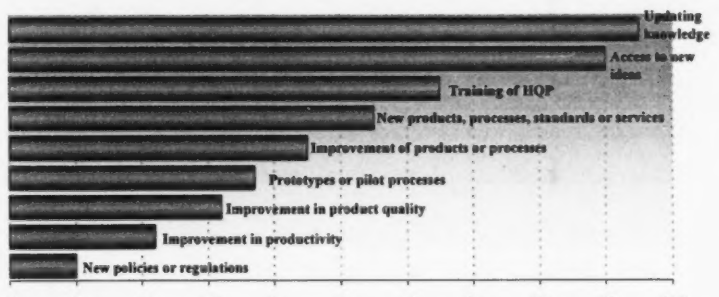
In 2007-08, a total of $25.9M was leveraged from partners on Strategic Project grants versus NSERC's funding of $67M. Given the pre-competitive nature of the Strategic Project grants, the resulting leverage ratio of 39% shows good partner participation.

In 2004, a five-year follow-up of NSERC's Strategic Project grants was undertaken. Interviews were conducted with a total of 229 Strategic Project grant recipients (66% response rate) and 127 partners (67% response rate) from either industry or government. The margins of error for the two samples are ±5 percentage points for the university researcher sample and ±8 percentage points for the industry sample, with a 95% confidence interval. Some of the highlights from the survey are presented below:

- Almost all respondents indicated that their Strategic Project grant experience had been worthwhile (i.e., 99.6% of university researchers, 95.7% and 100% of industry and public sector partners respectively).
- In assessing post-award collaboration, a total of 163 researchers (i.e., 71%) indicated that they had continued to collaborate with their strategic project grant partners. This represents 144 researchers (i.e., 64%) who continued working with the same partner(s) in the same area as their strategic project grant, and an additional 19 researchers (i.e., 8%) who indicated that they continued to work with their partners, but on different projects.
- Figure 30 presents the benefits industry and government partners realized from their participation on the Strategic Project grant.

Overall, the Strategic Projects program is achieving its main objectives and is resulting in significant HQP production and knowledge transfer to the user community.

Figure 30
How Partners Used Results from an NSERC Strategic Project Grant



Source: NSERC

The NSERC Strategic Partnerships Programs are designed to focus on priorities (NSERC Strategic Target Areas) and so provide an excellent framework to implement the S&T Strategy. In 2007-08, NSERC's commitment to the *S&T Strategy* through the Strategic Partnerships program included:

- Re-scoping and repositioning the descriptions for NSERC's three target areas (Advanced Communications and Management of Information; Healthy

Environment and Ecosystems; and Sustainable Energy Systems) to align more directly with the S&T Strategy priority areas.

- Increased funding in the 2007 competition ($4.4M/yr for 3 years) to support 30 additional projects in the priority areas of Environment, Energy and ICT. A total of 101 additional researchers and 59 partners are involved in these projects and we anticipate more than 150 students will be trained.
- Launched a special supplemental competition to rapidly increase research and partnerships in the three target areas (Advanced Communications and Management of Information; Healthy Environment and Ecosystems; and Sustainable Energy Systems) aligned with the S&T Strategy priority areas. A total of 160 awards were made at an annual investment of $15M per year over the next two years (see an example of one of the funded grants below).
- Six additional Strategic Networks (public-private research partnerships) in the three priority areas of the environment, ICT and energy/natural resources.
- To better align with *S&T Strategy*, the Strategic Network Grants Program has been redesigned to enhance international research and training and accelerate the transfer of knowledge and new technology into use in the Canadian economy.

Advanced Communication and Management of Information

Title: New generation intelligent user interface for effective and ubiquitous and pervasive communication.
Applicant: Zhang, Wenjun (Chris) (Mechanical Engineering, U. of Saskatchewan)
Co-applicants: *Schneider, Barry B (Psychology, Ottawa);* Gutwin, Carl (Computer Science, Saskatchewan); Shi, Yang (Mechanical Engineering, Saskatchewan).
Supporting Organization(s): Immersion Canada; MPB Technologies Inc.

Summary:
The goal of this project is to develop a new generation of intelligent interface for human-computer and human-machine communications. While the main tasks of the project are to be accomplished by computer scientists and mechanical engineers, a thorough understanding of human behaviour is needed to provide the computer/machine with the appropriate tools to understand the human. The addition of a psychologist to the research team will allow them to correctly address the human behaviour issue, and to provide students with very valuable inter-disciplinary training.

2.3 Productive Use of New Knowledge in the NSE

Wealth is created when Canadians add value in producing goods and services that are sold in world markets and knowledge is the modern basis for adding value. NSERC aims to maximize the value of public investments in research for the benefit of all Canadians by promoting research-based innovation, university-industry partnerships, technology transfer activities and the training of people with the required scientific and business skill sets to create wealth from new discoveries in the NSE.

2.3.1 Fund University-Industry-Government Partnerships

An overview of the "fund university-industry-government partnerships" program activity is presented below:

Description		**Expected Results**	
This activity supports NSERC's priority of realizing the benefits of public investments in research by creating productive collaborations between university researchers and the industrial receptors who are able to create value from new discoveries.		Mutually beneficial collaborations between the private sector and researchers in universities, resulting in industrial or economic benefits to Canada.	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$115.0M	Professors	2,538
Actual Spending	$181.8M	Undergraduate Students	753
Planned Human Resources	79	Master's/Doctoral Students	1,764
Actual Human Resources	66	Postdoctoral Fellows	392

The key programs under this program activity are:

- **Collaborative Research and Development Grants ($45.1M)**: This program gives companies operating from a Canadian base access to the unique knowledge, expertise and educational resources available at Canadian postsecondary institutions and offers opportunities for mutually beneficial collaborations that result in industrial or economic benefits to Canada. It also facilitates world-class research and ensures a strong source of well-trained graduates. Funding for the Canadian Microelectronics Corporation ($8.6M) is included under this activity.

- **Networks of Centres of Excellence (NCEs) ($40.2M)**: The Networks of Centres of Excellence are unique partnerships among universities, industry, government and not-for-profit organizations aimed at turning Canadian research and entrepreneurial talent into economic and social benefits for all Canadians. These nationwide, multidisciplinary and multi-sectoral research partnerships connect excellent research with industrial know-how and strategic investment. They create a critical mass of research capacity by networking researchers and partners across Canada.

- **Strategic Network Grants ($16.5M)**: This program funds large scale, complex research programs that involve multi-sectoral collaborations on a common research topic. The topic to be investigated can be of local concern, requiring a focused local network, or of regional or national importance, requiring a larger, more complex network.

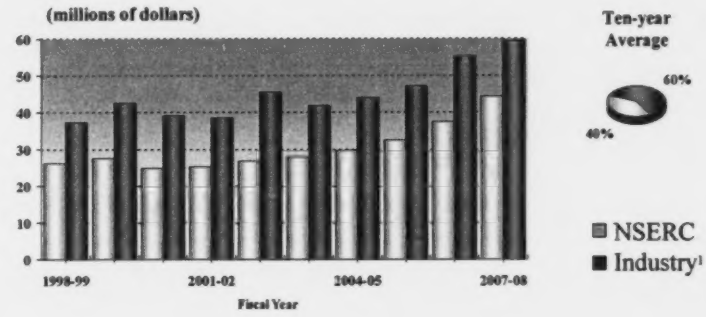
- **Research Partnership Agreements ($4.7M)**: A number of initiatives has been established through the Research Partnership Agreements signed with several federal government departments and agencies. The objective of these programs is to build strong linkages between the private sector, researchers in universities, and researchers in federal institutes.

A new program launched late in the fiscal year, **Centres of Excellence for Commercialization & Research ($57.2M)** and funding for the administration of the above programs rounds out the spending under this program activity.

Specific program outcomes as well as general performance measures related to knowledge and technology transfer will be presented. The general outcomes presented in this section also result from investments made in most of NSERC's other grants programs. As mentioned, it is very difficult to disentangle broad performance measures by NSERC program. Most of the expected results are part of the technology transfer process. This process can be described as the movement of ideas, tools and people from university professors and students supported by NSERC to the private and public sector. This movement leads to socio-economic benefits for Canadians as a result of NSERC research support.

The Collaborative Research and Development (CRD) program is intended to give companies operating from a Canadian base access to the special knowledge, expertise and educational resources at Canadian postsecondary institutions and to offer opportunities for mutually beneficial collaborations that result in industrial or economic benefits to Canada. Bringing university professors and Canadian firms together is one of the first methods of stimulating technology transfer. These industrial partners also contribute financially to these university research projects. Because of the socio-economic impacts of university research, NSERC views any additional investment in university research as having a positive impact on the Canadian economy. A comparison of NSERC funding to industry contributions for the CRD program is presented in Figure 31. Over the past decade, industrial contributions to the CRD program have outpaced NSERC's investment by over 50%, demonstrating the value Canadian industries place on university R&D and the training of students.

Figure 31
Contributions to NSERC's Collaborative R&D Grants (CRD) Program



1. Best estimate.
Source: NSERC.

NSERC tracks the outcomes of its Collaborative Research and Development (CRD) program by following-up with researchers and partners. Results from the latest review of reports (276 CRD reports that were submitted in the fiscal years 2004/2005 and 2005/2006) conducted in 2007 are described below:

- Out of 276 reports, 49% of the projects reported contribution to new products or processes and 67% of projects reported contribution to improved products or processes.

- There were 18 new licenses generated and 103 patents had been filed. Twenty four of those had been reviewed at the time reports were received. Start-up companies were created for 13 projects.

- There were 2,531 professionals trained as a result of CRD funding. About 50% of the total professionals trained were either undergraduates (26%) or masters' students (25%). Ph.D.s trained represented 17% of the total.

- There are very close interactions between partners and highly qualified personnel (HQP) with 70% of projects reporting that HQPs presented results to partners and 68% discussed projects directly with partners.

- CRD reports required an overall ranking to assess the extent to which overall objectives of the program were achieved. The answers were rated on a scale of 1

to 7 where 1 meant "not at all", the midpoint indicated "somewhat" and 7 indicated "to a great extent." 74% of reports responded with scale 6 and 7 indicating that objectives and milestones were achieved to a large extent. There were no responses that indicated that objectives were "not met at all".

- There were 557 publications that were co-authored by industrial partners.

Recent Evaluation

In 2007, the third evaluation in the past ten years of the Networks of Centres of Excellence program was conducted. The evaluation report is available at http://www.nce-rce.gc.ca/pubs_e.htm. Some of the key evaluation findings are presented below:

- The evaluation supports the rationale for the continuation of the NCE Program.

- While many of the positive outcomes of the NCE Program are shared with other network-related programs, it performs better than these programs in some key areas, such as the creation of structured networks, the establishment of intersectoral partnerships, and knowledge utilization — in particular, the commercialization of research findings. Clearly, there is an undisputed place for the NCE Program.

- The NCE Program offers more opportunities to students with regard to publication and conferences, ethical debates and exposure to real-life practices. Participation in the NCE Program also leads to a better fit between the field of study and employment.

- NCE networks have been successful at bringing together researchers, public sector and private sector representatives, and NGOs to contribute to the definition of key knowledge issues, the execution of research and the translation of research findings into actionable results.

- Networking and collaboration programs double the amount of knowledge transfer activities and increase knowledge utilization significantly according to researchers. This finding is true for NCEs as well as other network programs. When compared to the average government agency, there was vastly more research finding utilization among NCE public sector partners in 2006 than in the average government agency.

What follows is a more general presentation of important performance measures related to the productive use of new knowledge. Many NSERC programs have contributed to the successes illustrated below.

INVENTION DISCLOSURES, PATENTS AND LICENCES OBTAINED

Statistics Canada conducts a survey of intellectual property (IP) commercialization in the university sector every one to two years. The key results from the first five surveys are highlighted in Figure 32. The survey data are confidential and it is therefore impossible to link the outcomes in the figure below to NSERC funding. However, from NSERC's analysis of patents and publications, it is highly likely that the majority would be attributable to NSERC funding. The sizeable increases seen over the six-year period for most of the commercialization activities presented is a positive result. Other commercialization trends are presented below.

Figure 32
Survey of University Intellectual Property Commercialization

Commercialization Activity	1999	2001	2003	2004	2005
Inventions disclosed	829	1,105	1,133	1,432	1,475
Inventions protected	509	682	597	629	744
New patent applications	616	932	1,252	1,264	1,427
Patents issued	325	381	347	397	374
Total patents held	1,826	2,133	3,047	3,827	3,953
New licences	218	320	422	494	577
Total active licences	1,109	1,338	1,756	2,022	2,216
Royalties from licensing ($M)	$18.9	$52.5	$55.5	$51.2	$55.1
Total spin-off companies	454	680	876	968	1,028

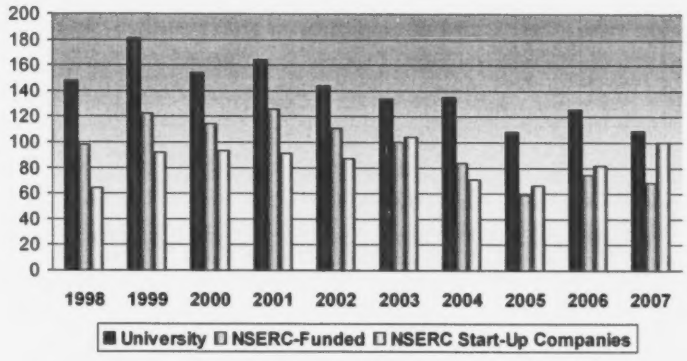
Source: Statistics Canada

As shown in Figure 32, Canadian universities are seeking patent protection at an increasing rate. Another measure of this activity is the number of U.S. patents being issued to Canadian universities. As shown in Figure 33, university patent production has averaged more than 100 patents per year for the past decade. An analysis of the 1,403 patents issued to Canadian universities over the past 10 years has found that 956, or 68%, of the patents listed an NSERC-funded professor as one of the inventors. In addition, start-up companies linked to NSERC have been issued 850 U.S. patents over the past decade. As shown in Figure 34, all NSERC-related patents combined account for 5% to 8% of the institutional U.S. patents assigned to Canadian organizations every year.

From NSERC's 2007 researcher's survey, patenting activity by the 2,590 respondents was considerable. Over the past five years, 360 Canadian patents and 723 U.S. patents were issued to NSERC-funded professors. This suggests that patent activity is more

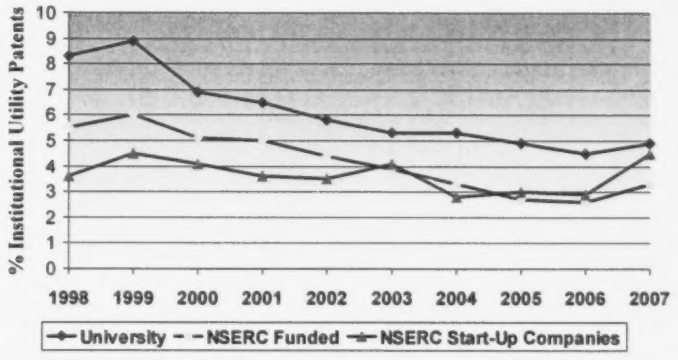
prevalent than can be seen from just an analysis of patents assigned to universities (i.e., many patents are held/owned by the professor instead of the university).

Figure 33
Number of U.S. Patents Issued to Canadian Universities and NSERC-Funded Start-Up Companies



Source: U.S. Patent Office database. Includes only utility patents.

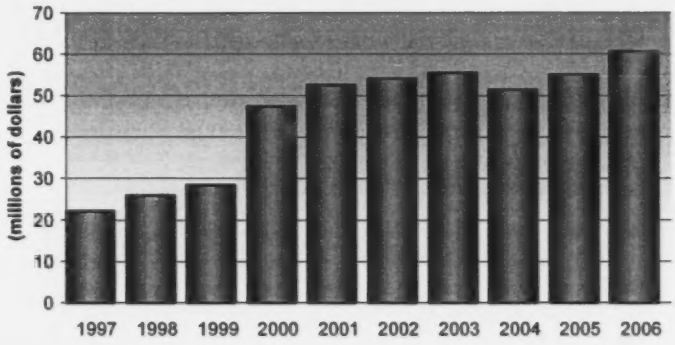
Figure 34
Percentage of Canadian Institutional U.S. Patents Issued to Canadian Universities and NSERC-Funded Start-Up Companies



Source: U.S. Patent Office database. Includes only utility patents.

Another way university research is transferred to industry is through a licence, giving the industrial buyer the right to commercialize the research. Commercial use of the licensed technology results in royalty income to the university and typically the researcher. The amount of licensing royalty revenues is another measure of the value of university research. Figure 35 presents licensing revenues for Canadian universities. Most of these revenues can be at least partially attributed to funding from NSERC and CIHR. The trend in revenue growth has generally been positive over the decade. Examples of licences based on NSERC-funded research are presented in Figure 36.

Figure 35
Canadian University Licensing Revenue
(millions of dollars)



Source: NSERC estimate based on Association of University Technology Managers data and Statistics Canada data for 2001, 2003, 2004 and 2005.

Figure 36
NSERC-Funded Innovations That Were Licensed

What	*Where*	*Who*	*Licensed to*
A microrobotic technology for automated microinjection of zebrafish embryos. High-speed injection of zebrafish embryos is important for screening genes in genetics and drug molecules in drug discovery.	University of Toronto	Dr. Yu Sun	Marksman Celliject Inc. (Toronto, ON)
Dr. Finlay's research led to the development of Econiche, the world's first vaccine designed to reduce the shedding of *E. coli O157:H7* by cattle. Most strains of *E. coli* are harmless but some, like *O157:H7*, can cause severe illness and even be fatal when ingested by humans. Vaccination of cattle with Econiche may help reduce the risk of food and water contamination by *E. coli O157:H7*.	University of British Columbia	Dr. Brett Finlay	Bioniche Life Sciences Inc. (Belleville, ON) The Canadian Food Inspection Agency licensed the vaccine for unrestricted use by Canadian cattle producers and their veterinarians.
Along with Dr. Malcolm Wilson, Dr. Tontiwachwithikul developed post-combustion, amine-scrubbing technology which uses an amine-based solvent to capture CO2 from flue gas after combustion.	University of Regina	Dr. Paitoon Tontiwachwithikul	HTC Purenergy (Regina, SK)
Along with graduate student Paul Kraeutner, Dr. Bird developed SARA-CAATI (Small Aperture Range Angle – Computed Angle-of-Arrival Transient Imaging.) Used on surface vessels, remotely operated vehicles or autonomous underwater vehicles, the SARA-CAATI system emits pulses, receives their echoes, processes the data and produces high resolution, 3-dimensional colour images of the seafloor.	Simon Fraser University	Dr. John Bird	Marport Canada Inc. (St. John's, NL)
Developed Organic Chemistry Flashware ™, a multimedia tool intended to help students conceptualise chemical reactions at the molecular level.	University of New Brunswick	Dr. Ghislain Deslongchamps	Thomson Nelson (Scarborough, ON)

START-UP COMPANIES ESTABLISHED

Every two years, NSERC engages in a detailed study to uncover firms that were created based on university research. The start-up companies uncovered have all been founded on results of research funded partially by NSERC. The 154 start-up companies featured (see Figure 37 on the next page) are currently in the business of producing goods and services for Canadian and international markets. Combined, these companies employ nearly 19,000 Canadians and generate more than $3.9 billion in annual sales/revenue. Creating innovative goods and services using the latest technologies, these firms make an important contribution to Canada's economy. In addition to the 154 firms, there are 77 early stage spin-offs with the potential for future growth.

NSERC Spin-off Facts

Active NSERC spin-off companies: 154

Early-stage NSERC spin-offs: 77

Acquired NSERC spin-offs: 32

TOTAL: 263

Employees (active companies): 18,922

Annual Revenues: $3.9 Billion

As of July 2008, 29 of the 154 start-up companies examined are/were publicly-traded firms. Although the gyrations of the markets have been significant in recent years, the market capitalization of these 29 publicly-traded firms on July 11, 2008 was an impressive $11.9 billion (see Figure 38). In addition to the direct economic benefits of contributing to Canadian GDP and employment, longer-term potential benefits of these start-up companies also exist. One already mentioned is the nearly 850 U.S. patents issued to the start-up companies over the past 10 years. Another secondary benefit has been the growth of major R&D firms in the country. In 2007, five of the top 100 Canadian R&D companies (as ranked by *Research Infosource*, 2007) were NSERC-related start-up companies with a combined R&D expenditure of $243M (see Figure 39). These results are important as Canada strives to increase R&D spending by Canadian firms.

ECONOMIC ANALYSIS

The highlights of a recent economic analysis of NSERC-funded start-up firms conducted by Torben Drewes, a professor of economics at Trent University, are shown below.

Determining the exact return on investment (ROI) for NSERC investments in technology start-ups is a challenging problem. Structural models are required to capture the impacts of technology transfer, enterprise survivor rates, and productivity effects of R & D activities within the start-ups. The ROI estimates produced should only be taken as broad indicators.

Nevertheless, these estimates should produce a reasonable level of confidence that NSERC's investments in new technology-based enterprises have resulted in very significant returns in the form of new economic activity. All assumptions have been made to result in a conservative bias. Assuming the combined output of the 154 enterprises used in the estimates remain stable or alternately increase by 10% per year and the degree of incrementality assigned to NSERC is only 10 percent, results in ROI figures of 2.6% or 12.9%. These ROI numbers are calculated against the total of NSERC expenditures over the past 30 years.

The conclusion must be that the sizeable investment of taxpayer funds used to convert knowledge into economic value through the development of start-ups is producing considerable value for Canadians.

Figure 37: Companies Linked to NSERC-Funded Research, 1954 to 2007
(Number of employees in Canada in 2007)

British Columbia

- MacDonald Dettwiler and Associates (1400)
- E-One Moli Energy (Canada) (430)
- QLT (384)
- Westport Innovations (140)
- TIR Systems (122)
- Freshxtend Technologies (50)
- NxtPhase (50)
- MIGENIX (37)
- Forbes Medi-Tech (28)
- Albacore Research (20)
- Phero Tech (20)
- JGKB Photonics (15)
- PhoeniX Technologies (15)
- Brightside Technologies (14)
- Actenum (12)
- Membrane Reactor Technologies (12)
- Wildlife Genetics International (9)
- Barrodale Computing Services (8)
- GeneMax Pharmaceuticals (8)
- MycoLogic (8)
- SynGene Biotek (8)
- Process Simulations (7)
- Quantum Technology (6)
- Syscor Research & Development (6)
- Advanced Integrated MicroSystems (Canada) (5)
- DBMiner Technology (5)
- Credo Interactive (4)
- Prescient NeuroPharma (4)
- Aurora Instruments (Confidential)

Alberta

- Stantec (2548)
- Raylo Chemicals (220)
- Wi-LAN (160)
- Biomira (106)
- Hycal Energy Research Laboratories (60)
- Harding Instrument Company (50)
- Dynastream Innovations (40)
- SemBioSys Genetics (40)
- ITRES Research (26)
- Cell-Loc Location Technologies (12)
- Zoomage (10)
- MBEC BioProducts (9)
- Chenomx (8)
- Smart Camera Technologies (8)
- Random Knowledge (7)
- AB BioPharma (5)
- Boreal Laser (5)
- CanBiocin (5)
- AgriGenomics (Confidential)

Saskatchewan

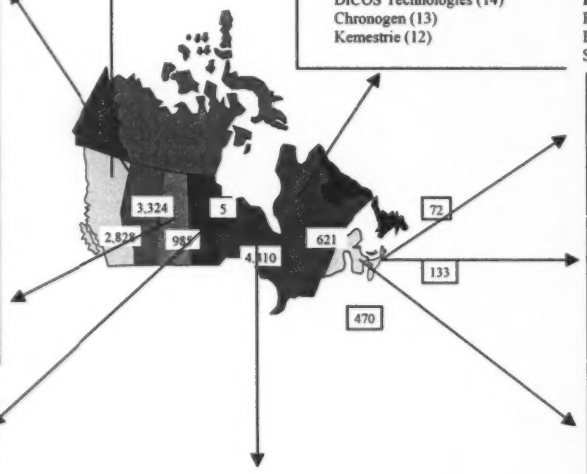
- VCom® (466)
- SED Systems-a division of Calian (225)
- International Road Dynamics (150)
- DEL-AIR Systems (100)
- Accutrak Systems (15)
- VEMAX Management (15)
- Droycon Bioconcepts (9)
- Western Ag Innovations (5)

Manitoba

- Quantic EMC (Confidential)

Quebec

- GIRO (160)
- Aegera Therapeutics (46)
- Tekna Systèmes Plasma (41)
- VoiceAge (40)
- LTRIM Technologies (35)
- BioAxone Therapeutic (32)
- INRO Consultants (27)
- Infolytica (24)
- SIMCO Technologies (17)
- Comlab (16)
- HERA, Hydrogen Storage Systems (15)
- Advitech (14)
- DiCOS Technologies (14)
- Chronogen (13)
- Kemestrie (12)
- Newmerical Technologies International (12)
- Quantiscript (12)
- Microbridge Technologies (10)
- Nanox (10)
- Service d'Expertise en Matériaux (S.E.M.) (10)
- GBBC Medica (9)
- Magistral Biotech (9)
- ENERKEM Technologies (8)
- Axiocom (6)
- MXT (6)
- AXIS Photonique (5)
- E.M Optimisation (5)
- Plasmionique (5)
- BytePress (4)
- SiXtron Advanced Materials (4)



Newfoundland

- AQUA Bounty Canada (30)
- Guigné International (25)
- A/F Protein Canada (10)
- Northern Radar (7)

Nova Scotia

- Ocean Nutrition Canada (256)
- Focal Technologies (85)
- AMIRIX Systems (70)
- Satlantic (40)
- MathResources (12)
- Thermo Dynamics (7)

New Brunswick

- CARIS (125)
- Interactive Visualization Systems (8)

Ontario

- DALSA (878)
- ZENON Environmental (850)
- MDS Sciex (500)
- Open Text (400)
- Platform Computing (275)
- Optech (210)
- iAnywhere Solutions (195)
- Virtek Vision International (166)
- Sybase Canada (115)
- Powerlasers (110)
- Certicom (105)
- Novator Systems (65)
- SatCon Power Systems Canada (65)
- Millenium Biologix (43)
- Pressure Pipe Inspection Company (40)
- Decision Academic (33)
- Hydromantis (33)
- Performance Plants (33)
- Ensyn Technologies (30)
- Dynacon (25)
- TurboSonic (25)
- Engineering Seismology Group Canada (22)
- BIOREM Technologies (21)
- Engineering Services (17)
- IGNIS Innovation (15)
- Techné Knowledge Systems (15)
- Axela Biosensors (14)
- Biomedical Photometrics (12)
- Vivosonic (12)
- BIOX (9)
- CVD Diamond (8)
- GeoTango International (8)
- Datec Coating (7)
- Qubit Systems (7)
- Sigma Analysis and Management (7)
- EnviroMetal Technologies (6)
- Interface Biologics (6)
- Elstat (5)
- Simulent (5)
- matREGEN (4)
- iGO Technologies (Confidential)
- Maplesoft (Confidential)

Figure 38
Market Capitalization of Start-up Companies

Company	Market Capitalization								
	July 11, 2008	June 20, 2007	July 21, 2006	June 28, 2005	June 14, 2004	July 28, 2003	July 29, 2002	August 15, 2001	June 12, 2000
Shire BioChem Pharma	$3,406 M[1]	$3,406 M[1]	$3,406 M[1]	$3,406 M[1]	$3,406 M[1]	$3,406 M[1]	$3,406 M[1]	$3,406 M	$3,607 M
MDS Sciex	$1,836 M	$2,646 M	$2,978 M	$- M	$- M	$- M	$- M	$- M	$- M
MacDonald Dettwiler	$1,292 M	$1,892 M	$1,617 M	$1,229 M	$1,038 M	$903 M	$727 M	$836 M	$- M
Stantec	$1,076 M	$1,669 M	$434 M	$563 M	$472 M	$341 M	$292 M	$208 M	$95 M
Open Text	$1,554 M	$1,171 M	$722 M	$858 M	$1,921 M	$728 M	$544 M	$638 M	$845 M
ZENON Environmental	$760 M[1]	$760 M[1]	$760 M[1]	$789 M	$633 M	$427 M	$429 M	$319 M	$153 M
Westport Innovations	$360 M	$207 M	$70 M	$103 M	$125 M	$110 M	$200 M	$303 M	$359 M
Biomira	$309 M	$138 M	$96 M	$163 M	$139 M	$100 M	$185 M	$460 M	$674 M
QLT	$269 M	$615 M	$654 M	$1,176 M	$1,668 M	$1,636 M	$1,177 M	$2,249 M	$6,152 M
DALSA	$187 M	$227 M	$261 M	$298 M	$392 M	$245 M	$123 M	$71 M	$49 M
Wi-LAN	$168 M	$417 M	$62 M	$35 M	$110 M	$94 M	$54 M	$85 M	$852 M
Vecima Networks	$139 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
TIR Systems	$75 M[1]	$75 M[1]	$26 M	$42 M	$103 M	$25 M	$10 M	$6 M	$6 M
AD OPT Technologies	$73 M[1]	$73 M[1]	$73 M[1]	$73 M[1]	$53 M	$34 M	$31 M	$36 M	$62 M
Certicom	$69 M	$173 M	$229 M	$191 M	$134 M	$42 M	$33 M	$125 M	$896 M
Cell-Loc Location	$39 M	$30 M	$14 M	$6 M	$9 M	$15 M	$47 M	$27 M	$- M
Fralex Therapeutics	$36 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Forbes Medi-Tech	$35 M	$31 M	$78 M	$71 M	$94 M	$52 M	$14 M	$73 M	$155 M
Migenix	$24 M	$64 M	$32 M	$25 M	$58 M	$22 M	$31 M	$- M	$- M
SemBioSys Genetics	$23 M	$45 M	$51 M	$57 M	$- M	$- M	$- M	$- M	$- M
Accelware	$19 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Virtek Vision International	$19 M	$25 M	$35 M	$21 M	$33 M	$17 M	$24 M	$60 M	$53 M
Innovatech	$15 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
International Road Dynamics	$15 M	$29 M	$18 M	$16 M	$- M	$- M	$- M	$- M	$- M
BIOREM Technologies	$11 M	$16 M	$21 M	$2 M	$- M	$- M	$- M	$- M	$- M
Biosyntech	$11 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Enwave	$10 M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Prescient NeuroPharma	$9 M	$15 M	$1 M	$1 M	$1 M	$4 M	$7 M	$- M	$- M
TurboSonic	$8 M	$18 M	$20 M	$8 M	$4 M	$6 M	$3 M	$- M	$- M
Advitech	$4 M	$6 M	$4 M	$1 M	$- M	$- M	$- M	$- M	$- M
FreshXtend Technologies	$2 M	$5 M	$8 M	$4 M	$- M	$- M	$- M	$- M	$- M
GeneMax Pharmaceuticals	$- M	$2 M	$2 M	$2 M	$13 M	$33 M	$21 M	$- M	$- M
Newmerical Technologies	$- M	$2 M	$2 M	$2 M	$9 M	$4 M	$- M	$- M	$- M
SatCon Power Systems	$- M	$51 M	$106 M	$59 M	$92 M	$17 M	$- M	$- M	$- M
TapImmune	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Welichem Biotech	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M	$- M
Innova LifeSciences	$- M	$- M	$- M	$- M	$38 M	$40 M	$35 M	$18 M	$21 M
Lumenon Lightwave Technologies	$- M	$- M	$- M	$- M	$- M	$2 M	$6 M	$- M	$- M
Kipp & Zonen	$- M	$- M	$- M	$- M	$- M	$2 M	$2 M	$- M	$- M
Magistral Biotech	$- M	$- M	$-M	$5 M	$- M	$- M	$- M	$- M	$- M
Millenium Biologix	$- M	$- M	$10 M	$48 M	$- M	$- M	$- M	$- M	$- M
Nexia Biotechnologies	$- M	$- M	$- M	$4 M	$40 M	$20 M	$66 M	$158 M	$- M
Polyphalt	$- M	$- M	$- M	$- M	$- M	$2 M	$9 M	$13 M	$- M
Total	**$11,853 M**	**$13,808 M**	**$11,790 M**	**$9,258 M**	**$10,585 M**	**$8,327 M**	**$7,476 M**	**$9,091 M**	**$14,470 M**

1. Market capitalization at time of buyout.
Source: Globe and Mail

Figure 39
R&D Spending of Top Start-Up Companies Linked to NSERC

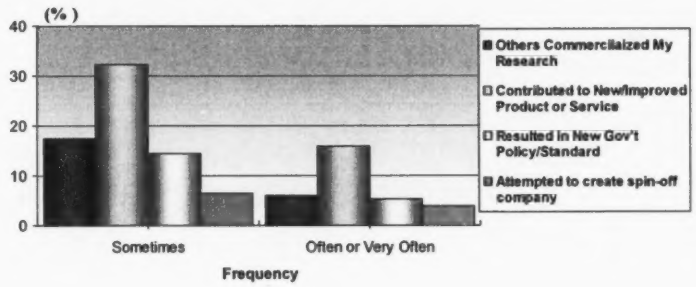
NSERC Funded Start-Up Company	Rank	R&D Expenditure (millions of dollars)
Open Text Corporation	37	$67.1
QLT Inc.	38	$64.0
MacDonald Dettwiler & Associates	54	$44.5
DALSA Corporation	58	$41.9
Westport Innovations	74	$25.6

Source: Research Infosource, Canada's Top 100 Corporate R&D Spenders List 2007

NEW AND IMPROVED PRODUCTS AND PROCESSES INTRODUCED TO MARKET

NSERC-funded researchers have created or developed many new products and processes, the value of which is difficult to estimate. Respondents to NSERC's 2007 researcher survey, previously mentioned, indicated significant involvement in the development of new goods or services (see Figure 40). Also as part of a past evaluation of NSERC's largest program, the Discovery Grants program, over 20% of the 3,032 respondents who held a grant indicated a major contribution to the development of new or improved products or processes. By way of example, Figures 41 to 44 list a sample of some of the new products or processes developed by NSERC-funded professors in the information technology, energy, environment, and health sectors, respectively.

Figure 40
NSERC-Funded Professors' Knowledge Transfer Activities Over Past 5 Years



Source: NSERC researcher survey 2007.

Figure 41

Information Technology Innovations Funded by NSERC

What	*Where*	*Who*	*Why*
Prototype for new magnet	University of Victoria	Dr. Robin Hicks	Developed a prototype for magnetic materials that could be used to make extremely thin magnetic computer memory and ultralight spacecraft parts.
Developed music composition software	University of Western Ontario	Dr. Mike Katchabaw	Dr. Katchabaw's team developed the Algorithmic Music Evolution engine, AMEE. The program allows users to import their own musical creations and even control the emotional content of the music. The researchers will further develop AMEE and present it to companies needing music for everything from cell phones to computer games.
Eyebox2™	Queen's University	Dr. Roel Vertegaal	Eyebox monitors eye movements in real time from up to 10 metres away so advertisers can track how many people look at their billboards and screens.
Wireless biosensors	Simon Fraser University	Dr. Bozena Kaminska	Dr. Kaminska developed disposable, wearable, wireless biosensors to be used as diagnostic and monitoring tools. The biosensors incorporate mixed-technology electronics developed in Kaminska's CiBER lab. CiBER is working with Nokia to develop a system for transmitting the data to cell phones that would send warning and emergency messages to care providers.
Developed software to catch cheaters	McMaster University	Dr. George Wesolowsky	Dr. Wesolowsky developed a software program designed to disclose who has cheated on a test. The program, called Scheck, uses statistical methods to detect cheating on multiple choice tests by looking at the patterns of people's answers.
Invented a device that generates power while you walk	Simon Fraser University	Dr. Max Donelan	Donelan's team created a device that generates enough power to run 10 cell phones or a couple of small computers – while you walk.
First execution of a quantum calculation	University of Toronto	Dr. Daniel James	Dr. James was part of the international team that made the calculation. The calculation represents a major step towards building the first quantum computers.

Figure 42

Energy Technology Innovations Funded by NSERC

What	*Where*	*Who*	*Why*
A solar hot-water heating system	Queen's University	Dr. Stephen Harrison	Dr. Harrison developed a solar panel with a mechanism that prevents overheating. He also created a passive back-flushing thermal system. Both inventions are part of a hot water system sold in North America by EnerWorks.
Created a better solar cell	Université de Québec à Montréal	Dr. Benoît Marsan	The new solar cell is flexible, inexpensive to manufacture, transparent and very versatile. While the idea is not new, the process and materials used are innovative. Marsan's team hopes to bring the cell to market within the next three years – not just for use in buildings, but also in cars, and maybe even on clothing. .
Superconductor breakthrough	University of Sherbrooke and University of British Columbia	Dr. Louis Taillefer, Dr. Nicolas Doiron-Leyraud and Dr. Douglas Bonn	Using uniquely pure crystals, the research team detected an elusive signature of electrons within a high-temperature superconductor. One of the most promising applications for the discovery is in magnetic levitation trains. The force of powerful magnets suspends the trains in the air above the rails, eliminating friction from moving parts.
Storing hydrogen safely	University of Windsor	Dr. David Antonelli	Dr. Antonelli discovered that using silica (a component found in glass) and titanium oxide helps store large quantities of hydrogen safely.
Discovered a new superconductor	University of Montreal	Dr. Andrea Bianchi	Dr. Bianchi headed the team that found the new superconductor – made of cobalt, indium and a rare earth that lets electricity flow freely, without loss of energy, when cooled to just a few degrees above absolute zero.
New way to trap gases in molecule-sized tanks	University of Calgary	Dr. George Shimizu	At the moment, gas storage can pose safety risks as it needs to be kept at very high pressures. The research team developed a crystal structure that can store gas molecules indefinitely without the need for pressure. They use 'molecular nanovalves' – and the system has the added bonus that gas can also be released easily.

Figure 43

Environment Innovations Funded by NSERC

What	*Where*	*Who*	*Why*
Wind tracking radar	University of Western Ontario	Dr. Wayne Hocking	Dr. Hocking leads an Ontario-Quebec research team that uses a specialized radar to track wind speed and directions. The team's first findings have shown large streams of ozone leaking from the stratosphere to almost ground level where it transforms into smog.
Fish harmed by common chemical	Mount Allison University	Dr. Suzanne Currie	Dr. Currie found that 4-nonylphenol (4-NP) disrupts the sense of smell in fish leading them to avoid each other instead of gathering in schools. The chemical is found in industrial detergents, sewage treatment and agricultural pesticides.
New technique to measure greenhouse gases	Carleton University	Dr. Matthew Johnson	This patented technique uses mathematical models and instruments to measure methane leaks in pipeline and gas flares at oil wells. The team discovered that emissions from gas flares and venting have been reduced by 42 per cent from 2002 to 2005.
Developed safe "green" decontaminatio n method for chemical warfare agents and pesticides	Queen's University	Dr. Stan Brown	Brown's team found a new method for rapidly and safely destroying toxic agents such as chemical weapons and pesticides.
Found new evidence drugs getting into drinking water	University of Waterloo	Dr. Mark Servos	Servos' team found painkillers such as ibuprofen, cholesterol-lowering drugs and the common household antibacterial agent triclosan in treated drinking water from 15 plants in the Burlington, Ontario region. Amounts are tiny, but researchers don't know the human health effects of long-term exposure, even to small amounts.

Figure 44

Health Innovations Funded by NSERC

What	*Where*	*Who*	*Why*
A new and improved hearing aid	McMaster University	Dr. Suzanna Becker and Dr. Ian Bruce	Invented the NeuroCompensator, a chip which trains hearing aids to hear sounds that damaged parts of the ear can't pick up. The patented technology has attracted interest from Cayce Medical.
Improved design of nano-scale sieve	University of Alberta	Dr. Jed Harrison	Along with graduate student Yong Zeng, Dr. Harrison improved upon an older model of molecular sieve. The new sieves cost much less to make and can be re-used 10 times. The sieve has potential applications in biomedical research – allowing researchers to separate viruses from fluid or tissue samples.
New device to detect scrapie	University of Guelph	Dr. Gordon Hayward and Dr. Warren Stiver	Created a new device that identifies prions, the root of scrapie, a fatal degenerative disease that affects the nervous systems of sheep. The researchers say the instrument could also be used for other degenerative diseases in the same family as scrapie, such as bovine spongiform encephalopathy, BSE, in cattle, and Creutzfeldt-Jakob disease in humans.
Technique to diagnose asthma in children	Dalhousie University	Dr. Geoffrey Maksym	Developed a more sensitive and reliable asthma diagnostic technique that measures the spasm in the smooth muscle which lines the airways.
Laser-enhanced microscope allows better views of cells	Queen's University	Dr. Albert Stolow and Adrian Pegoraro	Developed a technique involving a laser and microscope in order to view cell parts without using traditional dyes which can be toxic and alter the cellular environment.
Armrest that reduces repetitive strain injuries	University of Guelph	Dr. Michele Oliver	The armrest works by reducing muscle activities in the neck which helps prevent repetitive strain injuries. The device was originally designed for machinery operators, but can be used on any chair.
Playbot, a child's robotic wheelchair	York University	Dr. John Tsotsos	Created a motorized robotic wheelchair for children. The chair has a robotic arm, a camera and a communications panel.

2.3.2 SUPPORT COMMERCIALIZATION

An overview of the "support commercialization" program activity is presented below:

Description		Expected Results	
This program activity supports innovation and promotes the transfer of knowledge and technology to Canadian companies by supporting technology transfer activities at Canadian universities.		The transfer of knowledge and technology from Canadian universities and colleges to the user sector is facilitated.	
Resources (2007-08)		**Clients Supported (2007-08)**	
Planned Spending	$15.2M	Professors	105
Actual Spending	$10.7M	Undergraduate Students	28
Planned Human Resources	6	Master's/Doctoral Students	42
Actual Human Resources	12	Postdoctoral Fellows	15

The key programs under this program activity are:

- **Intellectual Property Mobilization (IPM) Program ($3.6M)**: Developed by NSERC in 1995, this program is now funded by NSERC, SSHRC and CIHR. The objective of this program is to accelerate the transfer of knowledge and technology residing in Canadian universities and hospitals for the benefit of Canada. The IPM program provides funding in partnership with universities and hospitals to support activities related to managing and transferring intellectual property resulting from publicly funded research performed at universities.

  Idea to Innovation (I2I) Program ($5.5M): I2I accelerates the pre-competitive development of promising technologies and promotes its transfer to Canadian companies. The program supports R&D projects with recognized technology-transfer potential by providing crucial assistance to university researchers in the early stages of technology validation and market connection.

Funding for the College and Community Innovation Program ($0.3M) and for the administration of the above programs rounds out the spending under this program activity.

As presented in Figure 32, university technology transfer offices are handling an ever-increasing load of intellectual property management.

In 2007-08 an evaluation of the IPM program was conducted, with the key findings summarized below:

- IPM has assisted institutions to develop the skills of university staff by providing funding for professional development initiatives. The most significant initiative has been regional internship training programs, which offer the following benefits: a relatively standardized approach to developing interns into technology transfer professionals; an effective mechanism for attracting qualified candidates;

and a way to reduce hiring risks by allowing them to evaluate the potential of a candidate over many months at low cost, without the obligation to hire them.

- Evidence gathered by the evaluation, in conjunction with data from Statistics Canada (see Figure 32), confirms that the rate at which technology is being transferred from universities and hospitals has increased dramatically in the last decade.

The Idea to Innovation program has been active since 2003. The program attracts between 80-120 Phase I proposals each year, while fewer Phase II proposals are received (6-12 per year).

As part of the program management, NSERC receives annual reports on the progress in the projects. A recent study by NSERC staff followed up on Phase I proposals that were funded, to better understand the issues leading to the low level of follow-on Phase II projects. This study of 74 grants identified that:

- 19% of the phase I projects were moving to Phase II
- 15% of the Phase I projects demonstrated that the technology was not feasible,
- For 8% of the grants, the technology was transferred without the need for further funding
- 30% of the teams were working with the partner to transfer the technology
- 26% of the projects were looking for a partner.

Section 3 – Supplementary Information

3.1 Departmental Links to Government of Canada Outcomes

NSERC investments contribute significantly to many of the Government of Canada's strategic outcomes. All of the NSERC-funded outcomes presented in Section 2 are linked to the Government of Canada outcome: an innovative and knowledge-based economy. Because NSERC funds research and training leading to a wide-range of economic and societal impacts in virtually every sector, many of NSERC's long-term outcomes are also directly linked to other important Government of Canada outcomes, such as strong economic growth, income security and employment for Canadians, a clean and healthy environment, healthy Canadians with access to quality health care, and safe and secure communities. It would be a significant challenge to develop performance measures and an attribution methodology for all of these outcomes. For the reason of simplicity, the "innovative and knowledge based economy" outcome is by far the most appropriate single outcome relationship for NSERC to use.

Table 1 presents 2007-08 expenditures by strategic outcome and program activity.

Table 1
Departmental Links to Government of Canada Outcomes

($ millions)	Operating	Grants	Total
Strategic Outcome #1: People			
Highly skilled science and engineering research professionals in Canada			
1.1 Promote Science and Engineering			
Main Estimates	$0.2	$3.9	$4.1
Planned Spending	$0.2	$3.9	$4.1
Total Authorities	$0.2	$3.9	$4.1
Actual Spending	$0.2	$4.2	$4.4
1.2 Support Students and Fellows			
Main Estimates	$6.8	$130.7	$137.5
Planned Spending	$6.8	$129.6	$136.4
Total Authorities	$7.3	$138.3	$145.6
Actual Spending	$6.4	$131.5	$137.9
1.3 Attract and Retain Faculty			
Main Estimates	$2.9	$163.8	$166.7
Planned Spending	$2.9	$164.9	$167.8
Total Authorities	$3.1	$163.4	$166.5
Actual Spending	$2.6	$145.4	$148.0
Strategic Outcome #2: Discovery			
High quality Canadian-based competitive research in the NSE			
2.1 Fund Basic Research			
Main Estimates	$16.4	$386.1	$402.5
Planned Spending	$16.4	$387.2	$403.6
Total Authorities	$17.9	$411.0	$428.9
Actual Spending	$18.8	$435.5	$454.3
2.2 Fund Research in Strategic Areas			
Main Estimates	$3.5	$52.8	$56.3
Planned Spending	$3.8	$53.9	$57.7
Total Authorities	$4.3	$64.8	$69.1
Actual Spending	$4.0	$71.4	$75.4
Strategic Outcome #3: Innovation			
Productive use of new knowledge in the NSE in Canada			
3.1 Fund University-Industry-Government Partnerships			
Main Estimates	$9.9	$105.1	$115.0
Planned Spending	$9.9	$105.1	$115.0
Total Authorities	$12.1	$171.9	$184.0
Actual Spending	$9.5	$172.3	$181.8
3.2 Support Commercialization			
Main Estimates	$0.7	$16.5	$17.2
Planned Spending	$0.8	$14.4	$15.2
Total Authorities	$0.8	$16.4	$17.2
Actual Spending	$1.4	$9.3	$10.7

3.2 Financial Tables

An agency overview of financial information for the year 2007-08 is provided below. In addition, Tables 2 to 4 present the financial information required from NSERC for the Departmental Performance Report. The agency's audited financial statements can be found in Appendix A.

Table 2 offers a comparison of the main estimates, planned spending, total authorities, and actual spending for the most recently completed fiscal year, as well as historical figures for actual spending. Planned spending is established in the Report on Plans and Priorities which was completed in March 2007. NSERC's actual spending was $112.7 million above planned levels. The variance is mainly due to a budget increase of $37 million and the creation of a new program: the Centres of Excellence for Commercialization & Research ($57.2 million).

Table 2: Comparison of Planned to Actual Spending (including FTEs)

($ millions)	2005–2006 Actual	2006–2007 Actual	2007–2008 Main Estimates	2007–2008 Planned Spending	2007–2008 Total Authorities	2007–2008 Actual
1.1 Promote Science and Engineering	$3.8	$4.0	$4.1	$4.1	$4.1	$4.4
1.2 Support Students and Fellows	$127.7	$128.0	$137.5	$138.4	$145.6	$137.9
1.3 Attract and Retain Faculty	$128.7	$145.2	$166.7	$167.8	$166.5	$148.0
2.1 Fund Basic Research	$417.7	$440.8	$402.5	$403.6	$428.9	$454.3
2.2 Fund Research in Strategic Areas	$56.0	$53.1	$56.6	$57.7	$89.1	$75.4
3.1 Fund University-Industry-Gov't Partnerships	$110.5	$112.3	$115.0	$115.0	$184.0	$181.8
3.2 Support Commercialization	$15.0	$12.0	$17.2	$15.2	$17.2	$10.7
Total	**$859.4**	**$895.4**	**$899.6**	**$899.8**	**$1,015.4**	**$1,012.5**
Less: Non-respendable revenue	-$1.1	-$1.6	N/A	-$1.0	N/A	-$1.0
Plus: Cost of services received without charge	$5.0	$5.4	N/A	$5.0	N/A	$5.6
Total Departmental Spending	**$863.3**	**$899.2**	N/A	**$903.8**	N/A	**$1,017.1**
Full-time Equivalents	300	308	N/A	319	N/A	327

Table 3 provides information on voted and statutory items while Table 4 presents transfer payment program financial data.

Table 3: Voted and Statutory Items
($ millions)

Vote or Statutory Item	Truncated Vote or Statutory Wording	2007–2008 Main Estimates	2007–2008 Planned Spending	2007–2008 Total Authorities	2007–2008 Actual
70	Operating expenditures	$36.6	$36.7	$41.8	$39.0
75	Grants and contributions	$858.9	$859.0	$969.7	$969.6
(S)	Contributions to employee benefit plans	$4.1	$4.1	$3.9	$3.9
	Total	**$899.6**	**$899.8**	**$1,015.4**	**$1,012.5**

Table 4: Transfer Payment Programs

($ millions)	Actual Spending 2005-06	Actual Spending 2006-07	Planned Spending 2007-08	Total Authorities 2007-08	Acutal Spending 2007-08	Variance between Planned and Actual
1.1 Promote Science and Engineering	$3.6	$3.8	$3.9	$3.9	$4.2	$0.3
1.2 Support Students and Fellows	$121.7	$121.9	$129.6	$138.3	$131.5	$1.9
1.3 Attract and Retain Faculty	$126.3	$142.7	$164.9	$163.4	$145.4	-$19.5
2.1 Fund Basic Research	$400.4	$422.4	$387.2	$411.0	$435.5	$48.3
2.2 Fund Research in Strategic Areas	$52.3	$49.4	$53.9	$84.8	$71.4	$17.5
3.1 Fund University-Industry-Government Partnerships	$103.2	$104.3	$105.1	$171.9	$172.3	$67.2
3.2 Support Commercialization	$13.7	$10.7	$14.4	$16.4	$9.3	-$5.1
Total Grants :	**$821.2**	**$855.2**	**$859.0**	**$969.7**	**$969.6**	**$110.6**
Contibutions :	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Other Transfer Payments :	$0.0	$0.0	$0.0	$0.0	$0.0	$0.0
Total Grants, Contributions and Other Transfer Payments :	**$821.2**	**$855.2**	**$859.0**	**$969.7**	**$969.6**	**$110.6**

Appendix A – Audited Financial Statements

For the year ended March 31, 2008

Auditor General of Canada
Vérificatrice générale du Canada

AUDITOR'S REPORT

To the Natural Sciences and Engineering Research Council
and the Minister of Industry

I have audited the statement of financial position of the Natural Sciences and Engineering Research Council as at March 31, 2008 and the statements of operations, equity of Canada and cash flow for the year then ended. These financial statements are the responsibility of the Council's management. My responsibility is to express an opinion on these financial statements based on my audit.

I conducted my audit in accordance with Canadian generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In my opinion, these financial statements present fairly, in all material respects, the financial position of the Council as at March 31, 2008 and the results of its operations and its cash flows for the year then ended in accordance with Canadian generally accepted accounting principles.

Nancy Y. Cheng, FCA
Assistant Auditor General
for the Auditor General of Canada

Ottawa, Canada
May 23, 2008

STATEMENT OF MANAGEMENT RESPONSIBILITY

Responsibility for the integrity and objectivity of the accompanying financial statements for the year ended March 31, 2008 and all information contained in these statements rests with the management of the Natural Sciences and Engineering Research Council. These financial statements have been prepared by management in accordance with Treasury Board accounting policies which are consistent with Canadian generally accepted accounting principles for the public sector, and year-end instructions issued by the Office of the Comptroller General.

Management is responsible for the integrity and objectivity of the information in these financial statements. Some of the information in the financial statements is based on management's best estimates and judgment and gives due consideration to materiality. To fulfil these accounting and reporting responsibilities, management maintains a set of accounts which provides a centralized record of the Council's financial transactions. Financial information submitted to the Public Accounts of Canada and included in the Council's Departmental Performance Report is consistent with these financial statements.

Management maintains a system of financial management and internal control designed to provide reasonable assurance that financial information is reliable, that assets are safeguarded and that transactions are in accordance with the *Financial Administration Act*, are executed in accordance with prescribed regulations, within Parliamentary authorities and are properly recorded to maintain accountability of Government funds. Management also seeks to ensure the objectivity and integrity of data in its financial statements by the careful selection, training and development of qualified staff, by organizational arrangements that provide appropriate divisions of responsibility, and by communication programs aimed at ensuring that regulations, policies, standards and managerial authorities are understood throughout the Council.

.../2

The financial statements of the Council have been audited by the Auditor General of Canada.

Approved by:

Dr. Suzanne Fortier
President

Michel Cavallin
Vice-President
Common Administrative Services Directorate
(Senior Financial Officer)

May 23, 2008

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL
STATEMENT OF OPERATIONS
FOR THE YEAR ENDED MARCH 31
(thousands of dollars)

	2008	2007
EXPENSES (Note 4)		
Fund Basic Research	456,779	442,472
Fund University-Industry-Government Partnerships	182,576	112,935
Attract and Retain Faculty	148,359	145,290
Support Students and Fellows	138,715	128,615
Fund Research in Strategic Areas	75,822	53,456
Support Commercialization	10,801	12,034
Promote Science and Engineering	4,383	3,999
Total Expenses	1,017,435	898,801
REVENUES		
Fund Basic Research	4	2
Total Revenues	4	2
Net cost of operations	1,017,431	898,799

The accompanying notes form an integral part of these financial statements.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL
STATEMENT OF FINANCIAL POSITION
AS AT MARCH 31
(thousands of dollars)

	2008	2007
ASSETS		
Financial assets		
Due from the Consolidated Revenue Fund	3,063	3,190
Accounts receivable (Note 5)	2,626	3,058
Advances	359	337
Total Financial Assets	**6,048**	**6,585**
Non-financial assets		
Prepaid expenses	221	250
Tangible capital assets (Note 6)	5,626	6,109
Total Non-Financial Assets	**5,847**	**6,359**
TOTAL	**11,895**	**12,944**
LIABILITIES		
Accounts payable and accrued liabilities (Note 7)	5,056	5,228
Vacation pay and compensatory leave	1,506	1,456
Employee severance benefits (Note 8b)	4,735	4,496
Total Liabilities	**11,297**	**11,180**
EQUITY OF CANADA	**598**	**1,764**
TOTAL	**11,895**	**12,944**

Contractual obligations (Note 9)

The accompanying notes form an integral part of these financial statements.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL
STATEMENT OF EQUITY OF CANADA
FOR THE YEAR ENDED MARCH 31
(thousands of dollars)

	2008	2007
EQUITY OF CANADA		
Equity of Canada, beginning of year	1,764	783
Net cost of operations	(1,017,431)	(898,799)
Net cash provided by Government (Note 3c)	1,010,826	894,367
Change in due from the Consolidated Revenue Fund	(127)	21
Services provided without charge from other government departments (Note 10a)	5,566	5,392
Equity of Canada, end of year	**598**	**1,764**

The accompanying notes form an integral part of these financial statements.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL
STATEMENT OF CASH FLOW
FOR THE YEAR ENDED MARCH 31
(thousands of dollars)

	2008	2007
OPERATING ACTIVITIES		
Net cost of operations	1,017,431	898,799
Non-cash items included in net cost of operations:		
Amortization of tangible capital assets (Note 6)	(1,933)	(2,208)
Services provided without charge from other government departments (Note 10a)	(5,566)	(5,392)
Loss on disposals of tangible capital assets	(3)	(6)
Variations in Statement of Financial Position		
(Decrease) increase in accounts receivable	(432)	1,915
Increase (decrease) in advances	22	(3)
(Decrease) increase in prepaid expenses	(29)	183
Decrease (increase) in accounts payable and accrued liabilities	172	(1,374)
Increase in vacation pay and compensatory leave	(50)	(102)
Decrease in other liabilities	-	154
Increase in employee severance benefits	(239)	(187)
Cash used by operating activities	**1,009,373**	**891,779**
CAPITAL ACTIVITIES		
Acquisitions of tangible capital assets	1,453	2,588
Cash used by capital activities	**1,453**	**2,588**
FINANCING ACTIVITIES		
Net cash provided by Government	**(1,010,826)**	**(894,367)**

The accompanying notes form an integral part of these financial statements.

NATURAL SCIENCES AND ENGINEERING RESEARCH COUNCIL

NOTES TO THE FINANCIAL STATEMENTS

1. Authority and objective

The Natural Sciences and Engineering Research Council (NSERC) was established in 1978 by the *Natural Sciences and Engineering Research Council Act*, and is a departmental corporation named in Schedule II to the *Financial Administration Act*. Its objective is to promote discovery and innovation and support both research and the provision of highly qualified personnel in the natural sciences and engineering. The Council delivers its objective under seven program activities:

a) *Fund Basic Research*: Invest in discovery through grants focusing on basic research activities.

b) *Attract and Retain Faculty*: Aim to attract and retain faculty.

c) *Support Students and Fellows*: Support training of highly qualified personnel through scholarship and fellowship programs.

d) *Fund University-Industry-Government Partnerships*: Foster collaborations between university researchers and other sectors, including government and industry, in order to develop new knowledge and expertise, and to transfer this knowledge and expertise to Canadian-based organizations.

e) *Fund Research in Strategic Areas*: Fund project research of national importance and in emerging areas that are of potential significance to Canada.

f) *Support Commercialization*: Support innovation and promote the transfer of knowledge and technology to Canadian companies.

g) *Promote Science and Engineering*: Encourage popular interest in science, math and engineering and aim to develop science, math and engineering abilities in Canadian youth.

The Council's grants, scholarships, and operating expenditures are funded by budgetary lapsing authorities. Employee benefits are funded by statutory authorities.

2. Summary of significant accounting policies

The financial statements have been prepared in accordance with Treasury Board accounting policies which are consistent with Canadian generally accepted accounting principles for the public sector, and year-end instructions issued by the Office of the Comptroller General. The most significant accounting policies are as follows:

(a) Parliamentary appropriations

The Government of Canada finances the Council through Parliamentary appropriations. Appropriations provided to the Council do not parallel financial reporting according to generally accepted accounting principles since they are based in large part on cash flow requirements. Consequently, items recognized in the Statement of Operations and the Statement of Financial Position are not necessarily the same as those provided through appropriations from Parliament. Note 3 provides information regarding the source and disposition of these authorities and a high-level reconciliation between the basis of reporting.

(b) Net cash provided by Government

The Council operates within the Consolidated Revenue Fund (CRF). The CRF is administered by the Receiver General for Canada. All cash received by the Council is deposited to the CRF and all cash disbursements made by the Council are paid from the CRF. The net cash provided by Government is the difference between all cash receipts and all cash disbursements, including transactions with departments of the federal government.

(c) Due from the Consolidated Revenue Fund

Due from the Consolidated Revenue Fund represents the amount of cash that the Council is entitled to draw from the CRF, without further appropriations, in order to discharge its liabilities.

(d) Revenues

Revenues consist of interest on overdue accounts receivable and are accounted for as earned.

(e) Expenses

Expenses are recorded on the accrual basis:

- Grants and scholarships are recognized in the year in which the entitlement of the recipient has been established, when the recipient has met the eligibility criteria, the commitment has been approved, and the payment is due before the end of the fiscal year.
- Vacation pay and compensatory leave are expensed as the benefits accrue to employees under their respective terms of employment.
- Services provided without charge by other government departments and agencies are recorded as operating expenses at their estimated cost.

(f) Employee future benefits

- Pension benefits: Eligible employees participate in the Public Service Pension Plan, a multi employer plan administered by the Government of Canada. The Council's contributions to the Plan are charged to expenses in the year incurred and represent the total Council's obligation to the Plan. Current legislation does not require the Council to make contributions for any actuarial deficiencies of the Plan.
- Severance benefits: Employees are entitled to severance benefits under labour contracts or conditions of employment. These benefits are accrued as employees render the services necessary to earn them. The obligation relating to the benefits earned by employees is calculated using information derived from the results of the actuarially determined liability for employee severance benefits for the Government as a whole.

(g) Accounts receivable

Accounts receivable are stated at amounts expected to be ultimately realized. A provision is made for receivables from external parties where the recovery is considered uncertain.

(h) Tangible capital assets

All tangible capital assets and leasehold improvements with an acquisition cost of $2,500 or more are capitalized at cost as well as the standard furniture, equipment and desktop personal computer assigned to each employee due to the material number of such items. Tangible capital assets are amortized over their estimated useful life on a straight-line basis as follows:

Asset class	Amortization period
Informatics equipment including standard software issued on desktop computers	3 years
Purchased network software and in-house developed software	5 years
Other equipment	5 years
Furniture	7 years
Leasehold improvements	Lesser of their useful life or the term of the lease

(i) Measurement uncertainty

The preparation of financial statements in accordance with Treasury Board accounting policies which are consistent with Canadian generally accepted accounting principles for the public sector, and year end instructions issued by the Office of the Comptroller General requires management to make estimates and assumptions that affect the reported amounts of assets, liabilities, revenues and expenses reported in the financial statements. At the time of preparation of these statements, management believes the estimates and

assumptions to be reasonable. The allowance for employee severance benefits and the estimated useful lives of capital assets are the most significant items where estimates are used. Actual results could differ significantly from those estimated. Management's estimates are reviewed periodically and, as adjustments become necessary, they are recorded in the financial statements in the year they become known.

3. Parliamentary appropriations

The operations of the Council are funded through annual Parliamentary appropriations. Items recognized in the Statement of Operations and the Statement of Financial Position in one year may be funded through Parliamentary appropriations in prior, current or future years. Accordingly, the Council has different net results of operations for the year on a government funding basis than on an accrual accounting basis. The differences are reconciled in the following tables:

(a) Reconciliation of net cost of operations to current year appropriations used

	2008	2007
	(thousands of dollars)	
Net cost of operations	1,017,431	898,799
Adjustments for items affecting net cost of operations but not affecting appropriations:		
Add (less):		
Interest on overdue accounts receivable	4	2
Refunds of previous years' expenses	1035	1,604
Amortization of tangible capital assets	(1,933)	(2,208)
Vacation pay and compensatory leave	(50)	(102)
Services provided without charge by other Government Departments and agencies	(5,566)	(5,392)
Employee severance benefits	(239)	(187)
Other adjustments	352	135
Adjustments for items not affecting net cost of operations but affecting appropriations:		
Add (less):		
Acquisitions of tangible capital assets	1453	2,588
Prepaid expenses	(29)	183
CURRENT YEAR APPROPRIATIONS USED	**1,012,458**	**895,422**

(b) Appropriations provided and used

	2008	2007
	(thousands of dollars)	
GRANTS AND SCHOLARSHIPS		
Vote 75	969,768	861,154
Less: Lapse/Frozen allotment	(190)	(5,956)
Grants and scholarships expenditures	969,578	855,198
OPERATING EXPENDITURES		
Vote 70	41,799	38,873
Less: Operating Lapse	(2,787)	(2,325)
Operating expenditures	39,012	36,548
Statutory contributions to employee benefit plans	3,868	3,676
CURRENT YEAR APPROPRIATIONS USED	**1,012,458**	**895,422**

(c) Reconciliation of net cash provided by Government to current year appropriations used

	2008	2007
	(thousands of dollars)	
NET CASH PROVIDED BY GOVERNMENT	1,010,826	894,367
Refund of previous years' expenses	1,035	1,604
Variation in accounts receivable	432	(1,915)
Variation in advances	(22)	3
Variation in accounts payable and accrued liabilities	(172)	1,374
Variation in other liabilities	-	(154)
Other adjustments	359	143
CURRENT YEAR APPROPRIATIONS USED	**1,012,458**	**895,422**

4. Expenses

The following table presents details of expenses by category:

	2008	2007
	(thousands of dollars)	
Grants and scholarships		
Fund Basic Research	435,264	421,524
Fund University-Industry-Government Partnerships	172,271	104,169
Attract and Retain Faculty	145,353	142,433
Support Students and Fellows	131,410	121,678
Fund Research in Strategic Areas	71,360	49,298
Support Commercialization	9,272	10,647
Promote Science and Engineering	4,150	3,774
	969,080	**853,523**
Operations		
Salaries and employee benefits	29,345	28,031
Professional and special services	6,427	4,816
Transportation and communications	4,443	4,097
Accommodations and rentals	4,113	4,071
Amortization of tangible capital assets	1,933	2,209
Information	1,191	1,235
Utilities, materials and supplies	533	587
Repair and maintenance	367	226
Loss on disposals of tangible capital assets	3	6
	48,355	**45,278**
Total Expenses	**1,017,435**	**898,801**

5. Accounts receivable

	2008	2007
	(thousands of dollars)	
Other federal government departments and agencies	1,974	2,023
External parties	688	1,071
Less: Allowance for doubtful accounts	(36)	(36)
Total	2,626	3,058

6. Tangible capital assets

(thousands of dollars)

	Cost				Accumulated amortization				Net book value	
Capital asset class	Opening balance	Acquisitions	Disposals and write-offs	Closing balance	Opening balance	Amortization	Disposals and write-offs	Closing balance	2008	2007
Informatics	4,037	530	269	4,298	2,897	709	266	3,340	958	1,140
Software	5,656	104	-	5,760	3,394	731	-	4,125	1,635	2,262
Other equipment	266	1	24	243	259	2	24	237	6	7
Furniture	3,084	716	21	3,779	1,879	266	21	2,124	1,655	1,205
Leasehold improvements	2,183	102	-	2,285	688	225	-	913	1,372	1,495
Total	**15,226**	**1,453**	**314**	**16,365**	**9,117**	**1,933**	**311**	**10,739**	**5,626**	**6,109**

Amortization expense for the year ended March 31, 2008 is $1,933 ($2,208 in 2007).

7. Accounts payable and accrued liabilities

	2008	2007
	(thousands of dollars)	
External parties	4,150	3,931
Other federal government departments and agencies	906	1,297
Total	5,056	5,228

8. Employee benefits

Employees of the Council are entitled to specific benefits on or after termination or retirement, as provided for under various collective agreements or conditions of employment.

(a) Pension benefits

The Council's employees participate in the Public Service Pension Plan, which is sponsored and administered by the Government of Canada. Pension benefits accrue up to a maximum period of 35 years at a rate of 2 percent per year of pensionable service, times the average of the best five consecutive years of earnings. The benefits are integrated with Canada/Québec Pension Plans benefits and they are indexed to inflation.

Both the employees and the Council contribute to the cost of the Plan. The 2007-08 expense amounts to $2,820,004 ($2,709,311 in 2007-08), which represents approximately 2.1 times the contributions by employees.

The Council's responsibility with regard to the Plan is limited to its contributions. Actuarial surpluses or deficiencies are recognized in the financial statements of the Government of Canada, as the Plan's sponsor.

(b) Severance benefits

The Council provides severance benefits to its employees based on eligibility, years of service and final salary. These severance benefits are not pre-funded. Benefits will be paid from future appropriations. Information about the severance benefits, measured as at March 31, is as follows:

	2008	2007
	(thousands of dollars)	
Accrued benefit obligation, beginning of year	4,496	4,309
Expense for the year	389	376
Benefits paid during the year	(150)	(189)
Accrued benefit obligation, end of year	4,735	4,496

9. Contractual obligations

Payments of grants and scholarships extending in future years are subject to the provision of funds by Parliament. As of March 31, 2008, the commitments for future years' awards are payable as follows:

	(thousands of dollars)
2008-2009	837,546
2009-2010	543,463
2010-2011	346,582
2011-2012	210,677
2012-2013 and subsequent years	132,319
Total	2,070,587

In addition, the nature of the Council's operating activities can result in some large multi-year contracts and obligations whereby the Council will be committed to make future payments when the services or goods are rendered. Significant contractual obligations that can reasonably be estimated are summarized as follows:

	(thousands of dollars)
2008-2009	155
2009-2010	146
2010-2011	69
2011-2012	24
2012-2013 and subsequent years	2
Total	396

10. Related party transactions

The Council is related as a result of common ownership to all Government of Canada departments, agencies and Crown Corporations. The Council enters into transactions with these entities in the normal course of business and on normal trade terms.

During the year, the Council received services which were obtained without charge from other government departments as presented in (a):

(a) Services provided without charge

	2008	2007
	(thousands of dollars)	
Accommodations provided by Public Works and Government Services Canada	3,760	3,579
Contributions covering the employer's share of employees medical and Dental insurance premiums provided by Treasury Board Secretariat	1,739	1,749
Other services received without charge	67	64
Total services received without charge	5,566	5,392

(b) Administration of programs on behalf of other government departments

The Council administers funds received from other federal government departments and agencies to issue grants, scholarships and related payments on their behalf. During the year, the Council administered $18,581,430 ($19,797,115 in 2007) in funds for grants and scholarships. These expenses are not reflected in the Council's Statement of Operations but rather are recorded in the financial statements of the departments or agencies that provided the funds.

The Council also recovers administrative fees in some circumstances where a significant administrative burden is incurred by the Council for the administration of certain funds on behalf of other federal government departments and agencies. These amounted to $601,717 during the year ($802,809 in 2007) and were netted against the Council's operating expenses.